Electrical World

The Consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.

VOL. XLVII. NEW YORK, SATURDAY, JANUARY 27, 1906. No. 4.

PUBLISHED WEEKLY BY THE

McGraw Publishing Company

114 LIBERTY STREET, NEW YORK.

TELEPHONE CALL: 7605 CORTLANDT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

EDITED BY T. C. MARTIN AND W. D. WEAVER.

CHICAGO OFFICE.....1139 Monadnock Block
PHILADELPHIA OFFICE.....Real Estate Trust Building
CLEVELAND OFFICE.....405 Cuyahoga Building
EUROPEAN OFFICE.....Hastings House, Norfolk St., Strand, London, Eng.

TERMS OF SUBSCRIPTION

United States, Canada, Cuba and Mexico.....Per year, $3.00
Foreign Countries, within the Postal Union.....$6.00
Great Britain and Ireland.....25 shillings
Germany.....25 marks
France.....31 francs
Single copy.....10 cents

Remittances for foreign subscriptions may be made through our European office. Requests for changes of address should be made one week in advance, giving *old* as well as new address. No copies are kept on sale beyond fifteen months from date of issue, except in bound volumes.

Copyright, 1906, by McGRAW PUBLISHING CO.

Entered as second-class matter at the post office at New York, N. Y., under the Act of Congress of March 3, 1879.

NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office one week in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Saturday of the same week.

Of this issue of the ELECTRICAL WORLD *16,000 copies are printed. The total circulation of the* ELECTRICAL WORLD AND ENGINEER *for the year 1905 was 712,500 copies, an average of 13,702 copies per issue.*

NEW YORK, SATURDAY, JANUARY 27, 1906.

CONTENTS.

Editorial 185
Discussion on Railway Substations at Chicago..... 188
Cooperative Stimulation of Electrical Development..... 188
Lightning Protection Upon Electric Railways..... 189
Fighting Fraud Against Corporations..... 189
Competition Between American and German Electric Manufactures in the World's Markets 189
Polyphase Transformation 190
The Municipal Plant of Cumberland, Md..... 190
Electrical Engineers of the Times.—XLVI. Mr. Charles R. Underhill 191
Current News and Notes..... 192
The Hydro-Electric Plant of the City of Sofia, Bulgaria. By Franz Koester 195
The Electrical Distribution System of the Public Service Corporation of New Jersey.—III. (Concluded.) By G. U. G. Holman..... 196
Burglar Insurance at Dubuque..... 198
Convention of the Northwestern Electrical Association at Chicago.... 199
Quadrant Electrometer as a Wattmeter..... 204
First Annual Convention of the Electrical Salesmen's Association..... 204
New Telephone Patents..... 204
LETTER TO THE EDITORS:
Speed of Machine Telegraphy. By Donald Murray..... 205
Digest of Current Electrical Literature 205
Book Reviews 209
Curtis Steam Turbines in Mining Work..... 211
Testing Equipment of the Electro-Dynamic Company..... 210
Prismatic Reflectors for Incandescent Lamps..... 211
Intermittently-Operated Elevator Pump Induction Motor..... 212
Electrical Features of a Textile Mill..... 212
25,000-Ohm Resistance Coil..... 212
A Simple Composing Machine for Advertising Matter..... 213
The Chicago Electrical Show..... 214
Industrial and Commercial News..... 218
General News 221
Weekly Record of Electrical Patents..... 230

ELECTRIFYING ELECTRICITY.

It might seem to most people that there was nothing particular to complain about in the rate and rapidity of electrical development during the past 50 years, which have seen the various applications in the electrical field in America attain a total investment and capitalization of over $5,000,000,000, a yearly electrical expenditure of the American people of $1,000,000,000, and an annual production of over $200,000,000 of electrical apparatus. For a good many of us, however, such advance is slow, such figures are small, such development is tame. It is certainly true that some branches of electrical industry have not been made the most of by those engaged in them, and in a general way it is also true that the public could use electricity a great deal more than it now does. A plan is afoot for the co-operative stimulation of electrical development, and Mr. J. Robert Crouse, Jr., has been its special advocate for some time past, as already noted in these pages. His idea is that a small percentage tax on present production put into advertising and "publicity" would bring notable returns to the whole art and industry. Elsewhere in this issue appears an argument from Mr. Crouse on this subject, to which careful attention should be given by every one whose self interest should induce him to join in such a campaign.

THE NORTHWESTERN ELECTRICAL CONVENTION.

The convention last week of the Northwestern Electrical Association in Chicago was a distinct advance over its predecessors of recent years. The great success scored by the Chicago meeting was largely due to retiring President Williams and to the cooperation which he received from a live executive committee. These gentlemen some time ago energetically took up the matter of the preparation of a programme, laying down the policy that it should include only topics of live interest to operating central station men, and that papers should be printed long enough in advance to insure adequate discussion. The immediate result was a most gratifying revival of interest in the association, good attendance at the sessions and excellent discussions. There is now every promise of a bright future if the energetic and up-to-date policy of the outgoing management is continued; and the adoption of a plan whereby the board of directors shall include three past-presidents is a guarantee of continuity of policy. A few years ago economy of production and distribution were the principal topics discussed at Northwestern conventions, but the recent awakening of interest in the more purely business side of the central station was strongly reflected in the papers presented at the Chicago meeting and in their discussion. Of all the subjects taken up at the convention, those pertaining to the organization of the business-getting departments of a central station excited by far the most interest, though matters relating to the engineering side were by no means ignored.

Elsewhere we print abstracts, together with the following discussions, of all the papers presented at the meeting except two which are reserved for our issue of next week. These latter are the paper by Mr. George Williams on "Organization and Development of a New Business Department," which led to the most

important discussion of the meeting; and the paper by Mr. W. D. Burford on "Underground Construction," which was also discussed at some length. Mr. Kimball, in his paper, spoke very encouragingly of the future of the Middle West as a manufacturing center and of the probable ensuing growth of demand for central station power for small and large factories in that territory. The situation which he presented, and which applies to the entire country, so far as relates to extension of electric power, should inspire central station companies to prepare for growth of power load by placing their generating stations on a good basis with respect to economy of generation and the study and adoption of systems of rates which will invite this class of business to central stations instead of being diverted through the installation of isolated steam plants. While this in some sections is, of course, largely a matter of the future, yet on the course of central station companies during the next five years will depend the business of many following years.

Perhaps the most interesting point brought out in the discussion on meters was the experience showing that complaints of customers as to inaccuracy of meters may be largely obviated by teaching them to read their own meters and how to make rough tests as to their accuracy. As a rule, if a customer is interested enough to make complaint as to the accuracy of his meter, he will be sufficiently interested to listen to explanations offered, and if at all reasonable will be inclined to follow advice provided that it is offered in terms that he can understand and in a spirit to which he cannot take exception. The idea of educating the customer in meter reading and testing is not at all new, literature with this end in view having been published by manufacturing companies and supplied to central stations; and where advantage has not been derived from this plan, it has not been as much the fault of the customer as of the central station through neglect, either to adopt it or to carry it out properly. Judging from the discussion, the more recent types of meters do not require to be inspected as frequently as the older types. As meter inspection tests form quite an item of expense—though within bounds one well justified—it is gratifying to know that with modern meters this can safely be reduced. Another paper of value from the data it gives is that by Mr. Gonzenbach on combining lighting and railway plants. While there is no doubt that a plant for operating both railway and lighting circuits can be designed to secure a high combined economy, in consolidating existing railway and lighting plants frequently the economy anticipated has not been realized; and this would have probably been indicated by the careful preliminary study which should always be made of all the conditions, local and engineering, affecting final economy.

Central Station Power Business in Small Towns.

There is probably no respect in which central station companies operating under the same conditions differ more widely than in the amount of power business they are carrying. For example, in one rural village in Illinois with a population less than 3,000, the maximum power load reaches 65 kw. While no figures are obtainable as to the average load in this village, it is safe to say that it is higher than in an adjoining city of 14,000 inhabitants where the average load is only about 15 kw. There are neighboring towns where there is almost nothing in the way of small manufacturing and where all the power used in the town is in a few very large factories which have generating plants of their own, as large, or larger than that of the central station company. These are exceptional conditions, however. The rural village of 3,000 inhabitants and the city of 14,000 referred to were neither of them remarkable either for the presence or the absence of the usual amount of power business. In fact, in the rural village all the available power load had not been secured. The large town was one having plenty of small industries which were power consumers. The facts of the case seem to be that the management of the combined electric lighting and gas company in the large town had considered the electrical end of the business simply as a necessary evil, and had made no attempt to cultivate the power load. This is apt to be the weakest point of consolidated electric light and gas companies, although there are notable exceptions.

The development of the power business is not by any means a question of very low rates or competition. Of course, low rates help develop a business and are necessary to secure the large power users, but they are not the only key to success along this line by any means. How inefficient low rates are in building up a power business unless they are used in conjunction with other means of pushing the business, was forcibly brought to attention recently in a visit to a city where conditions were no better than in the larger of the two towns before referred to, as far as the amount of power business was concerned. Power was being sold at a regular rate of 5c. per kw-hour. There had been two companies in the town to compete for business, yet the power load was merely nominal, in fact, hardly enough to pay for keeping the station in operation during the day. This may interest those who think a low price alone is the only thing necessary to get business. In all probability more business could have been secured in the town at 8c. or 10c. per kw-hour, provided the management had gone after the power business in the right way.

Method of Measuring Inductance.

There are numerous methods now known and available for the measurement of the inductance of a coil or a conductor. These are capable of being classified in various ways. One method of classification is with reference to the source of measuring current. Thus there are methods which involve the use of a voltaic battery and commutator, others which involve low-frequency alternators, and yet others which involve high-frequency alternators, or oscillating condenser charges. The high-frequency methods are generally preferred for measuring very small inductances, such as the inductance of a copper rod a few feet long. On the other hand, the battery and low-frequency methods are generally applied to the measurement of larger inductances. As mentioned in the Digest this week, Messrs. E. and W. H. Wilson have recently described in the London *Electrician* a method of measuring self-inductance, using low-frequency, alternating currents. The method is interesting, because it seems to be applicable to the measurement of very small inductances; i. e., inductances of the order of a metre, in absolute value. It employs a quadrant electrometer and an air-cored series transformer.

Results are reported on the inductances of wattmeter and ammeter shunts of strip metal. An alternating current of sufficient strength to produce a potential difference of one volt in the shunt is employed. This potential difference is led to the quadrants of the electrometer, while the secondary winding of the series transformer produces an e.m.f. of about 500 volts, connected between the electrometer needle and the case of the instrument. The

voltage between the quadrants would thus be exactly in phase with the current, if the shunt under test were devoid of inductance. The secondary voltage in the transformer would also be exactly in quadrature with the current, ignoring the secondary open-circuit impedance. Consequently, the alternating voltage of the needle being in quadrature with that between quadrants, there would be no resultant deflection of the needle. But the effect of inductance in the tested shunt will be to bring the voltage across the tested shunt behind the phase of the current and thus out of quadrature with the voltage of the needle. The magnitude of the resulting deflection of the needle, therefore, permits the inductance to be evaluated. The method is evidently very simple and convenient of application. When applied, however, to measuring very small inductances, it would seem that care would be necessary to eliminate disturbances, not only of adjustment in the electrometer, but also in the capacity and inductance of the secondary circuit of the transformer. In other words, when the method is applied to its limits, it needs to be demonstrated that the voltage of the needle is strictly in quadrature with the current, in spite of small capacity in the secondary circuit, and also that the alternating current is for all practical purposes devoid of disturbing harmonics.

POWER SCHEMES FOR THE RAND.

To judge from the projects now under way there is little danger that the great mines of the Transvaal are long to be without an adequate supply of power, whatever may be done as regards the Chinese labor question. Not only is the Victoria Falls proposition being pushed to the front, but the rival power project outlined last year by Mr. Robert Hammond is rapidly being exploited. The two projects are of a character that raises some extremely interesting practical questions. On the one hand we have a transmission of about 700 miles through the wilds of Africa from the tremendous Falls of the Zambesi, and on the other a short transmission from cheap though rather poor coal in the neighborhood of the Rand. There is a fine appeal to the imagination in the former that counts for something even in these days of sordid money grubbing. To take out of the heart of the African continent power from the mightiest cataract on the eastern hemisphere, and to transmit it more than twice as far as human enterprise has ever dared before, to the richest mines that ever tempted avarice, is a fact the thought of which quickens and tingles a little even the most stagnant blood. But capital is timid when working at its own risk, and the palmy days of African company promotion have passed. Mr. Hammond's rival plan is no more sensational than making a railway cut or building a breakwater. It is a cold-headed grasping of local conditions and utilizing their resources with calculating deliberation. Here are seams of coal, poor to be sure, as steam coal goes, but easily mined; not far away is the Vaal River with plenty of water for condensation; and there, fifty or sixty miles away, is the auriferous Rand.

There is nothing very risky about such a proposition if the market can be secured on contracts stable enough to justify the outlay. The cost of delivering power at the bus-bars can be calculated from known data with a very good degree of precision. The transmission of the energy involves neither a desperate struggle with nature nor any uncertainty as to the ultimate results. The voltage necessary is within the range of common experience, and neither methods nor apparatus need be in any sense experimental. It is, in short, a proposition frankly commercial such as a score of engineers would take up and put through without raising an eyebrow. Its value as a paying enterprise depends merely on what can be done with the market. There is very little reason to doubt that Mr. Hammond's estimate of 1.4 cent per kw-hour as a practicable selling price for energy delivered can be realized, and we fancy that if he could guarantee a good load at that figure for a reasonable term of years he could find plenty of American capital. But how about Victoria Falls? Mr. Esson has recently stated that the estimated cost of a single circuit for bringing 20,000 kw to the Rand is about $5,000,000—in other words $250 per kw as capital charge for the transmission line alone. If that figure is correct it implies at any reasonable figure for interest, care and maintenance, an annual charge per unit which would come very near to paying the whole expense of generating and transmitting from the steam power proposed. There seems to be considerable difference of opinion as to the cost of developing hydraulic power at Victoria Falls, but it certainly is not an amount at all negligibly small, and when added at any plausible figure to the costs of generation and transmission, it leaves a precious small margin upon which to compete with power locally generated and distributed. The crux of the whole matter seems to be in keeping down that tremendous investment and expense for the transmission.

In a previous state of existence of the Victoria Falls project, much was made of the value of copper as an investment. That it is likely to depreciate greatly from its normal price in years past seems improbable, and yet copper strung up in the wilds of South Africa cannot be regarded as a quick asset. To make the proposition attractive from a financial standpoint we should wish to see the cost of the transmission very greatly reduced below the figure mentioned. To this end the energy of the engineers must be bent. The problem of dealing successfully with voltages now considered transcendental must be solved, as it very likely will be. More than this, the cost of the conductor itself must be reduced. If the present high price of copper should be anywhere nearly maintained, which seems improbable, there may be a dull time in power transmission. Perhaps the best outlook is toward the more extensive use of aluminum. To-day being manufactured by special processes at only a few points, it can be held in price just below the cost of the equivalent copper conductor, but this condition of affairs cannot be a permanent one, unless all signs fall. With aluminum wire at twenty cents a pound or thereabouts, a price at which it can be sold at a profit one of these days, if not just now, the economies of line construction will wear a very different aspect. As things look an increasing production and use of aluminum is the most cheerful fact that the engineer has to contemplate. Not only copper but most of the other metals used in the arts have of late risen seriously in price, and unless aluminum comes to the rescue the outlook in many directions is rather bad. But this aside, the success of the Victoria Falls project or of any other of like kind, turns entirely upon the line costs, which are mainly controlled by the practicable voltage. As we have previously suggested, the best thing for those interested is to get down to business at once and carry out a series of experiments at high voltage upon a scale that will render them valuable as precedents as well as tests. Hydraulic power is often very cheap merely because it is unutilizable by reason of its isolation. To render it valuable, high voltage is the thing that really counts, and by which most future enterprises must stand or fall.

Discussion on Railway Sub-Stations at Chicago.

A meeting of the Chicago branch of the American Institute of Electrical Engineers was held the evening of January 16, to discuss the papers on sub-stations recently presented before the A. I. E. E. in New York. In the absence of Mr. K. B. Miller, chairman of the Chicago branch, the meeting was presided over by Mr. L. E. Ferguson, vice-president of the Chicago Edison Company.

Prof. P. B. Woodward gave brief outlines of the papers by Messrs. Ashe and Ricker, abstracts of which were printed in these columns in the issue of December 23, 1905.

Mr. George A. Damon, being called upon to lead the discussion, spoke especially of the comparative infrequency with which it is possible to apply Kelvin's law in designing sub-stations and deciding upon their locations in actual engineering practice.

Mr. P. Junkersfeld said it was generally the practice in large systems to start rotary converters from the direct-current side, while in small sub-stations starting from the alternating-current side was more common. The units selected should be as large as can be economically operated. Real estate and buildings formed a very important percentage of the total sub-station investment in large cities. In order to avoid the losses due to possible abandonment of rotary converter sub-stations because of changes in the art, it is becoming customary to design these buildings so that they would be useful for other commercial purposes in the localities in which they are situated should they ever be abandoned as sub-stations.

Mr. J. M. S. Waring, referring to the failure of storage batteries to respond quickly enough in the case of short circuits to prevent rotary converters from flashing over, called attention to the fact that nearly all batteries operating on railway loads in the United States are used in connection with boosters which, of course, influenced the quickness of their action.

Mr. Ernest Lunn, taking up the point of the quickness of battery response to overloads and short-circuits thought that the resistance drop in the plates was a more important factor than the slowness of the chemical action of the battery. Low resistance in the plates and terminal lugs would help the battery materially in responding quickly.

Mr. Bion J. Arnold stated that at one time he had thought that the storage battery possessed advantages in the way of improving the load factor of the engines and thus of improving the fuel economy. He remarked that he is now not so sure that the battery actually improves the fuel economy, but it undoubtedly gives greater reliability of service. A common argument against batteries is that they cost as much as engines and generators for carrying the same amount of load. Nevertheless, he thought batteries more economical for carrying short peak loads of from one to two hours' duration than the equivalent capacity of engines and boilers would be.

Mr. Winslow thought that there should be used at least one of the three following protective devices; namely, overload relays on the alternating-current side of the converters, reverse current relays on the alternating-current side of the converters, reverse current relays on the direct-current side and speed limiting devices. He spoke of some overload time limit relays operating in from three to six seconds with 100 per cent overload.

Mr. W. G. Carlton said that there was great difficulty in securing relays which could be adjusted so that there would be any appreciable difference in the time taken to operate on short-circuits. Considerable investigation and testing had failed to discover any time-limit devices which could be placed on feeders at sub-stations and at power stations with the assurance that they could be set so that there would be sufficient difference in the time of operation on short-circuits, to cause the circuit breakers at the sub-station to open before those at the power station.

Mr. Edward Schildhauer thought it to be desirable to cut out a line instantly in the case of short-circuit. Relays set for operation in six seconds at 100 per cent overload should operate instantly on short circuits.

Mr. Junkersfeld called attention to the fact that of all the protective devices enumerated, the one limiting the speed of rotary converters was the only one installed primarily to protect apparatus. The other devices were for the protection of the service from interruption by preventing the spread of disturbances. After all, protection of the apparatus was not a very serious question in practice, as was shown by the fact that on a large system having from 55 to 60 switchboards operators and aggregating about 70,000 kilowatts in machinery capacity, only three cases of damage to rotary converters had occurred in five years of operation. It was protection of service rather than protection of apparatus than was to be sought for.

Co-operative Stimulation of Electrical Development.

From time to time during the past nine months we have taken occasion to call attention to the plan outlined by Mr. J. Robert Crouse, Jr., for the co-operative development of electrical production and consumption, the idea having been first formally presented by him at the Denver electric light convention last June. We are now in receipt from Mr. Crouse of an important contribution on the subject, given in extenso below, to which we would direct attention. As one identified for many years with the incandescent lamp industry, the carbon business, and the manufacture of electrical glassware, Mr. Crouse has had unusual opportunities to become informed as to the general situation, and the opportunities of development by means of systematic, united effort. The communication follows:

A few introductory remarks with your indulgence, possibly at the expense of platitude, as to the basis and theory of this proposed co-operation. Association and co-operation are increasingly the watchwords of modern commercialism. "Competition is the life of trade" crystallizes the sentiment of a period in business development which is merging into a new régime, characterized by the sentiment "Co-operation is the life of trade."

Not co-operation of manufacturers or others to set prices or conditions of sale to the buyer, but broad-gauged co-operation among all the different interests through associations, societies or otherwise, working for general progress and improvement on the basis of the square deal. Through such co-operation furthermore developing the strength to attain an approximation to it.

The governors of the Western States believed the American people should see the wonders of the West before spending their money to visit Europe. They met and devised co-operative plans for bringing this about. This was modern co-operation.

The governors of thirteen Southern States appreciated that the South needed more people to develop her great natural resources. They recently met and made plans for co-operating in the expenditure of both time and money to accomplish this result. This was modern co-operation.

These two instances might be otherwise characterized as associated or co-operative self-interest. While experience amply proves that self-interest is the great "prime mover" in the affairs of men, the more widely it can be made co-operative or associated (necessitating the recognition of the rights of others) the more nearly it exercises its most proper and efficient function in the line of progress. May it not be well to consider whether there does not exist likewise in this great electrical field a common ground on the basis of which co-operation of this kind, in some degree at least, may be broadly undertaken to the advantage of all?

At first blush it may seem that our interests are too diversified and conflicting as manufacturers, publishers, jobbers, dealers, contractors, societies, associations, salesmen, central station, etc., but when we have reviewed all the interests, conflicting or harmonious, the fact remains that they form a continuous chain (kinks and all) from the manufacturer to the consumer.

This great body of 86,000,000 consumers, spending $12,000,000,000 annually, or putting it into the bank for future expenditure, controls the exchequer from which we are all, directly or indirectly, endeavoring to secure an honest livelihood in turn for the making, selling, installing or distributing of electrical apparatus, supplies and current. If this be true, it suggests that there does exist a community of interest among us all for the promotion of the increased use of electrical appliances and devices by the public for light, heat and power, as against all com-

petitive means and methods for the same purposes. Any increased success in accomplishing this through co-operation obviously predicates greater demand for "Everything Electrical," from the coal pile to the final appliances through which the public is electrically served.

The question then is, can any scheme of practical co-operation be devised which will bring about the result desired by all, and will such results probably be large enough to justify the expenditure of both time and money in their accomplishment? This is a subject which has interested the incandescent lamp manufacturers for a year past.

We believe such co-operation is not only possible, but profitably so. As "faith without works" is profitless, these manufacturers have backed their faith with an appropriation of $10,000, to which has been added another $10,000 from other sources, for the initiation of the plans.

It has been determined to undertake practical work along co-operative lines through the medium of the Co-operative Electrical Development Association. While this Association will look to the manufacturers generally for the revenue with which to prosecute the plans, equal importance is attached to securing the moral co-operation of all other electrical interests, societies and associations.

It would at this time be premature to go into the detailed plans of the new Association, until its activities had both aroused and justified sufficient interest in them. It may be said, however, by way of passing, that they have been fully and freely laid before many men in the various electrical interests, whose counsel and criticism has been sought and secured. Whatever degree of merit they may now possess is attributable to their hearty co-operation and encouragement. As initial progress in this work has been possible along these lines in the past, so, for the future, it points for continued and permanent success to systematic cultivation of the same sources of strength.

Your attention is respectfully called to certain campaigns of commercial business-getting literature which either are, or are about to be, issued to all the central lighting stations of the country, in direct line with the purpose of the new Association, through the medium of co-operating advertising agencies. The objects of the new Association are one in common with the electrical technical press along all lines looking to increased commercial activity, directly or indirectly, in the sale of current, and it will both seek their co-operation, and endeavor in turn to co-operate with them, along any practicable lines.

Finally, coincident with the recent and prospective great advances made by the mechanical and electrical engineers in increasing the efficiency of prime movers, the means of transmission, and the final appliances through which the public is served, this new Association stands for a vigorous attempt to match, and, if possible, to exceed, these accomplishments in the commercial field, through a general appeal to the selling ingenuity of the fraternity for effort along co-operative lines. To you, if sufficiently interested in the detailed plans of the new Association, as they have thus far been developed, the writer would be pleased upon rquest to submit the preliminary prospectus for criticism and comment.

Fighting Fraud Against Corporations.

The annual meeting of the Alliance Against Accident Frauds was held at the Hotel Astor, New York City, on January 17. Between forty and fifty traction companies were represented. These officers were elected: Russell A. Sears, of the Boston Elevated Electric Railroad, president; James R. Pratt, of the United Electric Railways Company, of Baltimore, vice-president; Chauncey S. Miller, of the Casualty Company of America, secretary and treasurer. Copies of barratry bills from different States were discussed and a sub-committee was appointed to draft a bill to check the operations of "shyster" lawyers, unprincipled physicians, paid witnesses and "ambulance chasers."

It is expected, judging by the attendance of representatives from Canada and the receipt of proxies from Great Britain, that the Alliance will become an international association. The Alliance has ample funds to defend its members from fraud. It is estimated that $450,000 is collected in this country each year by means of fraudulent and exaggerated claims.

Lightning Protection Upon Electric Railways.

An interesting recommendation in regard to lightning protection upon electric railways was made by Mr. H. W. Young, of the Westinghouse Company, at the December meeting of the New England Street Railway Club. Mr. Young pointed out the fact that many inherent failures heretofore erroneously ascribed to defective apparatus for lightning protection have now been eliminated, and urged the importance of co-operation on the part of operating companies with a view toward getting a better idea of the quantitative side of lightning disturbances. In order to secure as conclusive evidence as possible as to the operation of lightning arresters under actual service conditions, investigations are recommended with special test papers which can be placed in the discharge gaps of the arresters and so arranged that no discharge can pass the gaps without passing through the record paper.

Mr. Young recommended that every electric road should place the problem of lightning protection in the hands of a special man, equal in training to the average technical graduate or first year student with one of the large electric companies. It would be the sole duty of this man to map out the system, locate arresters, see that they were properly maintained and well grounded, use tell-tale boxes with paper records of their operation, and report regularly to the manager after each storm as to the damage done to apparatus, approximate loss of revenue, remedies applied, etc. He contended that the cost of doing this would be a small matter in view of the resulting benefits to the system. While this recommendation is perhaps somewhat radical—for it is difficult to believe that on any except the larger systems there would be work enough of this character to keep one man busy all the time—there is no doubt that more systematic efforts are necessary on the part of operating companies. There would seem to be no special difficulty in assigning the work outlined to the electrical staff of a company, holding some one operating engineer or assistant responsible for the condition of the lightning protection apparatus. Such an employe would in effect be superintendent of lightning protection, and his duties might well be undertaken by many other electric companies than those devoted purely to electric railway service.

Competition Between American and German Electric Manufactures in the World's Markets.

Some interesting statistical notes on competition between German and American electrical manufactures are given by Dr. Glier in the *Elektrotechnische Zeitschrift* of January 4. The writer states that in both the United States and Germany the electrical industries have grown to such dimensions that the output is larger than the home consumption. Both countries are, therefore, forced to export part of their production. While the yearly value of the export of electrical machines, appliances, etc., from Germany was in the average $11,000,000 during the last three years, the export from the United States in 1905 amounted to $12,000,000.

Which countries represent the battlefields of the rival manufacturers? Formerly it was Europe, and especially Great Britain, to which both countries chiefly exported. Thus, the export from Germany to Great Britain in 1902 represented 30 per cent of the total export; in 1903 it was 27 per cent and in 1904 it was 20 per cent. The export from the United States to Great Britain in 1901 and in 1902 was not less than 48 per cent of the total export, 39 per cent in 1903, 23 per cent in 1904, and 15 per cent in 1905. On the average during the years 1901 to 1903 the yearly export from Germany to Great Britain represented $1,306,500, and from the United States to Great Britain $2,530,000—that is twice as much as Germany. In recent years

however, the export from both countries to Great Britain has considerably diminished.

In Belgium, Russia, Italy, Spain, Netherlands, Sweden, Norway, Austria-Hungary and Switzerland, the German exporter does not appear to suffer from strong competition of the American exporter. The four chief European countries to which Germany exports are Great Britain, Russia, Belgium and Italy.

In countries outside of Europe, the American exporter appears to be ahead of the German exporter in almost every case. In Canada, Mexico and Japan the American exporter reigns supreme. These three countries bought from the United States in 1898 electric machinery at a value of $4,000,000 (20 per cent of the total), in 1904 $2,776,000 (49 per cent), and in 1905 $4,028,000 (53 per cent). The consumption of electrical machinery in these three countries is increasing, but this increase is completely covered by export from the United States. The exports from Germany to these three countries in 1904 amounted to $178,000.

With respect to South American countries, the export from Germany has increased to Argentine and Brazil; it amounted to $219,000 to Argentine, $52,000 to Brazil and $70,000 to Chili in 1904. The total exports to Argentine, Chili, Uruguay, Brazil and Peru were:

	1903	1904	1905
From Germany	$283,000	$360,000	$———
From United States	413,000	278,000	568,000

The exports from Germany to British Australia were $53,000 in 1903, $44,000 in 1904, while the United States exports in 1904 were $314,000 and in 1905 $662,000. In British East Indies the United States are also much better represented than Germany.

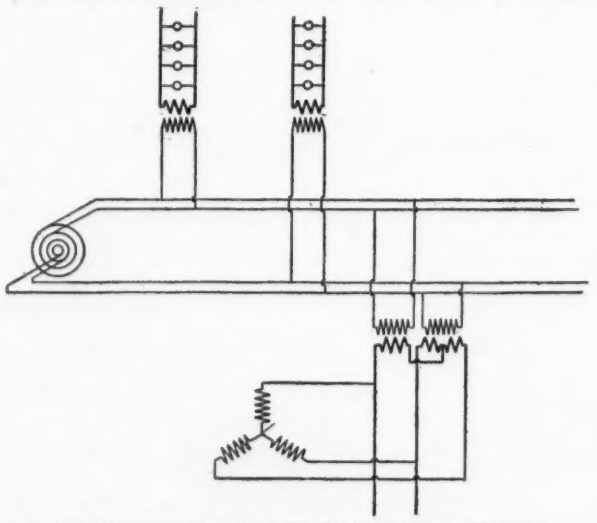
Strong rivalry still exists in British South Africa, with the Americans ahead. The exports from Germany were $75,000 in 1902 and $65,000 in 1903. The exports from the United States were $69,000 in 1902, $122,000 in 1903, $101,000 in 1904, and $114,000 in 1905.

Electric appliances are exported from the United States chiefly to Europe and especially to England; but Canada, Mexico and Japan are also good customers.

The only article of the electrical industries which is exported from Germany to the United States to any considerable extent is arc lamp carbons, the average amount for the years 1890 to 1894 being yearly $16,000, for the years 1895 to 1899, $70,000 and for the years 1900 to 1904 $44,000.

Polyphase Transformation.

A patent granted January 16 to Dr. C. P. Steinmetz on a system of electrical distribution is of particular interest at the present time, not so much on account of the technical information which it affords, but owing to the early date at which the application was filed and the broadness of some of the claims. The invention



STEINMETZ POLYPHASE TRANSFORMATION SYSTEM.

is indicated in the accompanying illustration. It relates in general to the transformation from two to three-phase, or from three to two-phase, as the case may be. The method employed seems to differ inappreciably from the one in common use at the present time.

The patent, the application for which was filed on April 13, 1894, contains 28 claims, three of which read as follows: "(14.) The combination of a plurality of transformer windings and a connection between the end or approximately the end of one winding and approximately the middle point of another of said windings; (15) The method of electric distribution herein set forth, which consists in generating three-phase currents, transmitting the same to a desired point or points, converting such currents into quarter-phase currents and utilizing such last-named currents for operating translating devices. (24) The method which consists in producing two-phase alternating currents transforming the same into three-phase, alternating currents, transmitting the energy in the form of three-phase, alternating currents and utilizing the energy thus transmitted."

It may be of interest in this connection to mention that the notable paper by Mr. C. F. Scott on "Polyphase Transmission," which first described the Scott system of transforming from three to two phases, was read before the National Electric Light Convention at Washington on March 1, 1894. It is noteworthy also that on August 24, 1893, in discussing a paper by Prof. F. B. Crocker before the International Electrical Congress, at Chicago, Dr. Steinmetz stated that any system of polyphase currents can be transformed into any other system of polyphase currents by using only two stationary transformers.

The Municipal Plant of Cumberland, Md.

A month or two ago considerable publicity was given in the newspapers to a dispatch from Cumberland, Md., stating that the cost of the municipal arc lighting plant there was only $34.06 per light per year, everything included. We have obtained a copy of the report upon which this claim is based, but do not find anything in the figures to support it. As we are at a distance from the place, we have asked a central station manager in Maryland to discuss and analyze the report, which he does in the subjoined communication:

The plant in question is working under very favorable conditions, but notwithstanding that, I can show a cost of nearly $60 per lamp. The plant was placed in a small building next to the water works, and by adding a few dollars to the water employees, and hiring an electrician and trimmer they were ready for business as far as salaries were concerned. Taking their figures, which are absolutely approximated, except salaries, we have $7,879.01 for salaries and labor, fuel and supplies, $2,280 6 per cent depreciation, interest on bonds $800, making a total of $10,959.01. Deducting $2,000, value of supplies on hand, the total cost was $8,959.01, or $34.06 per lamp for 263 lamps. But the plant has cost the city $40,000, and the machinery is of the antiquated design, with four of the five arc machines belted to one 18x24 engine, which is overloaded. There is no reserve, which means that it will not be long before the demand is greater than the capacity of the plant, while breakdowns must be provided for.

In my figures 10 per cent depreciation will be charged, although I think under the conditions 15 per cent is nearer the truth, but I want to be as conservative as possible.

Cost of plant, $40,000.		
Salaries and labor	$3,333.58	
Fuel	2,280.00	
Supplies	8,536.53	
		$7,897.01
Depreciation, 10 per cent. on $40,000		4,000.00
Interest on bonds and appropriation 6 per cent., $40,000		2,400.00
Additional fuel		366.40
Labor not considered		300.00
Oil, waste and packing		250.00
Lamp renewals		600.00
Repairs, engine and boilers		250.00
		$16,063.41
Deduct actual value supplies on hand		495.50
Total maintenance		$15,564.91

This amount divided by 263 lamps gives $59.10 per lamp per year.

In order to show the unwisdom of the city of Cumberland in going into the electric lighting business, when a company already formed and doing business stood ready to furnish lights as cheap as and in the long run cheaper than the city, even under favorable conditions; and also, because the information may be useful to other municipalities, that may have this subject under consideration—I take the liberty of submitting a history of the Edison and the municipal plants.

The Edison company began operation in 1884, and from the beginning lighted the streets and alleys, and all public buildings with incandescent lights. The original charge for street lighting, all night, and every night in the year was $10.80 for 10-cp lamps, and $12.00 for 13-cp lamps. Later all lights were changed to 16-cp lamps at $12 per year. About 1891 the Council asked for a few arc lights, and the company installed a Westinghouse 2,000-cp, 10-amp. arc system with the understanding that after arc lights were once available, the city would gradually replace the incandescent lights with arcs.

When the company first started the arc system, there were about five or six arc lamps on the circuit, and after about two years the number had grown to about a dozen. At this point it dropped the price from $100 to $91 per year per lamp. The city added a few lights each year, and at the end of 13 years the company were furnishing the city only 27 lights, and so scattered, that it required nearly 30 miles of wire to reach the lights. At this time the street lighting consisted of about 400 incandescent and 27 arc lamps, at a yearly cost of less than $7,500 per annum.

It is true the streets at that time were not as brilliantly lighted as at present, except where the arc lights were placed, but the 400 incandescent lamps covered all alleys, dark spots and holes in the city, impossible to reach with arc lights alone. Do not infer that I consider incandescent street lighting superior to arc street lighting. I bring this part of the history up merely to show that while the streets to-day are more brilliantly lighted under the present system, yet there are many dark alleys and holes to-day, that were formerly lighted with a 16-cp lamp, while it is costing the city 100 per cent more than when they were buying the service. If the city had accepted the price of $60 per year for arc lights, which was made to the committee appointed by the council to build the addition to the water works for the electric light plant, the city would be as well off financially, and considerably better off as far as distribution is concerned, and at a considerable less cost per year.

In the first place 175 arc lights properly placed would be sufficient, and at a cost of $60 per year would amount to $10,500, and 100 incandescent lights at $12 per year would make 275 lights at a cost of $11,700 per annum. Many of the city arc lights are erected at places where a 16-cp lamp would be satisfactory, and many dark holes, such as under shade trees, etc., that have no lights could be lighted to the satisfaction of the people, at a cost of $12 per year, so, 175 arc and 100 incandescent lights properly placed would give a better distribution than the present system, with a saving to the taxpayers of $4,000 per annum, and relief from the present antiquated plant. The problem is whether to add to the present junk pile, or throw it out, and spend $50,000 for a plant that will be adequate to supply the demands.

In 1897 a number of citizens thought the street lighting was costing too much and agitated for a municipal plant. As usual the cry struck a popular chord, as a cost of $35 per light was promised, and the plant was to cost only $20,000. The question was put to a vote of the people and was carried by a large majority. Accordingly, plans were drawn and bids asked for, but later were withdrawn, as no bids came within the amount of bond issue of $20,000.

The next move on the part of the citizens was to cheapen the plans so as to come under the $20,000 appropriation. In the meantime the company offered to furnish arc lights at $60, and tried to show the committee that $20,000 would not build the proper plant, and in fact the manager is on record as saying that if the city was bound to build the plant, they had better spend $40,000 and build a plant that would not have to be thrown out in a year or two. A construction company undertook to build the plant on the new plans, and after placing all the poles so that all the trees in the city came in contact with the wires, and placing 50 per cent of the poles 2 ft. in the ground instead of 6 ft., it broke up before the plant was completed.

The plant was finally placed in operation in September, 1898, and from the very first night was overloaded. They ran along for several years adding lights, until the engine was unable to pull the load, and it was necessary to do something. Advice was asked and I made a suggestion, and a rough idea of what was best to be done under the circumstances, and also advised them to secure the services of an efficient electrical engineer—which they did. The engineer, a capable man, looked the plant over thoroughly, and later submitted a report advising just about what I had suggested, viz., throwing out the original plant, and placing proper and up-to-date machinery, capable of not only caring for the present, but for the future, as well as making provision for the lighting of the city buildings.

Electrical Engineers of the Times.—XLVI.

MR. CHARLES R. UNDERHILL.

Charles Reginald Underhill was born in Chappaqua, N. Y., November 2, 1874. He attended the public schools until 1891, when he entered the employ of the Western Electric Company, New York, in the inspection department. This position gave him an excellent opportunity for the study of telegraphy and telephony, and while gaining a practical knowledge of applied electricity he also acquired a technical education by diligent evening study, and

MR. CHARLES R. UNDERHILL.

by correspondence instruction, which secured his promotion to the charge of the electrical testing and inspection in this department. During this employment Mr. Underhill designed a number of electrical testing devices, which greatly increased the efficiency of the department.

In 1900 Mr. Underhill accepted the position of chief electrical engineer of the Varley Duplex Magnet Company, and in 1901 went to Providence, R. I., the manufacturing department of this company being at the American Electrical Works. Realizing the lack of published data regarding electromagnets and solenoids to perform a given duty, Mr. Underhill devoted several years to the careful study of this branch of design, and in 1904 read a paper on the subject before the Northwestern Electrical Association. In the same year he published a book entitled "The Electromagnet," and a number of articles on electromagnets and solenoids for the technical press.

In the fall of 1904 Mr. Underhill engaged in consulting electrical engineering in New York. He is the inventor of an instrument for printing in English characters, Morse messages, from a regular Morse wire, which system, while not yet in commercial use, has attracted much favorable attention. Mr. Underhill is a member of the American Institute of Electrical Engineers.

CURRENT NEWS AND NOTES.

COLUMBIA UNIVERSITY.—The 1906 catalogue of Columbia University shows the total number of officers of administration and instruction to be 573, and the total number of resident students 4,755, as against 4,833 last year. These figures do not include the extension students, of whom there are nearly one thousand.

AWAITING ELECTRICITY.—In his first annual report to the New York Legislature, N. V. V. Franchot, State Superintendent of Public Works, points out that the number of boats navigating the State canals has fallen from several thousand to not more than 600. The superintendent recommends the abandonment of certain parts of unused canals, which would curtail the annual expenditures. The canal system is dying for want of electrification.

RECEPTION TO PROF. W. OSTWALD.—Previous to his departure for Europe, after a season of lectures at Harvard and Columbia, and elsewhere, Prof. Wilhelm Ostwald has consented to meet the members of the New York Section of the American Electrochemical Society and their guests on the evening of February 2 at the Chemists' Club, 108 West 55th Street. A number of prominent scientific men will make short addresses and a souvenir will be presented as a tribute of affection from his former students, as a recognition by his admirers of his services to electrochemistry. Members of the affiliated scientific societies of the city are especially invited to be present.

CHIP OF THE OLD BLOCK.—A telegram from Pittsburg of January 21 remarks: "George Westinghouse, Jr., only son of the inventor and manufacturer, is working in the Westinghouse electric plant at East Pittsburg as an apprentice. He was graduated from Yale last year, and after a few months' rest entered the shop on January 1 to learn the business. He receives precisely the same treatment as the other employes, carries his dinner in a tin pail, and rides from Solitude, the Westinghouse mansion, to the works in a street car. Young Westinghouse will take a complete course in electricity, going through all departments of the plant."

700-FOOT TOWER.—Announcement has been made by the Friede Globe Tower Company of its definite plans for a 700-ft. steel tower at Coney Island. The proposed tower will be 300 ft. in diameter and contain a pedestal roof garden, to be placed 150 ft. above the ground, including a restaurant, theatre and roller skating rink; an aerial hippodrome, 250 ft. above the ground; a moving café and dance hall, 300 ft. up; a palm garden at 400 ft., an observatory platform at 500, and still higher a branch of the Weather Bureau, including the largest revolving searchlight in the world. It is estimated that more than 7,000 tons of steel will be used in the structure, which is to be fire-proof, and the cost of which is placed at $973,500.

IN A LIBRARY.—An interesting illustration of the way in which electricity is superseding gas and oil for high-class illumination is found in the library of the Hotel Touraine, Boston. The library is well known to hotel patrons as one of the cosiest corners in the Hub, and its well-stocked bookshelves, easy chairs and open fire-place are deservedly popular with the guests of the house. The table lighting is accomplished by handsome lamps with standards and shades bearing a close resemblance to the familiar oil banquet lamps of earlier days; but in place of ill-smelling and leaky oil or of stifling gas burners the lamps are all equipped with incandescent electrics. The clean, cool and even illumination which results is a part of the atmosphere of this attractive room, and the use of electricity is a by no means negligible factor in the preservation of its handsome furnishings.

THE FRITZ GOLD MEDAL.—The John Fritz gold medal, founded on the occasion of the eightieth birthday of the veteran steel engineer and manufacturer in 1902, by the four national engineering societies, has just been awarded to Mr. George Westinghouse by the board of trustees. The medal is by the deed of foundation to be "awarded for notable scientific or industrial achievement" and the "specific achievement" which will be named on the certificate is the Westinghouse air brake. The first recipient of the Fritz medal was Lord Kelvin; Mr. Westinghouse is the first American. The medal represents in reality the initial results of united effort and co-operation among the national engineering societies. The next result has been the gift of Mr. Andrew Carnegie for the United Engineering Building, of over $1,000,000, the societies furnishing the land. Of the $200,000 required by the American Institute of Electrical Engineers, that society has already pledges for over $100,000.

NATIONAL ELECTRIC LIGHT ASSOCIATION.—Mr. W. C. L. Eglin, secretary of the association, announces that the twenty-ninth convention of the National Electric Light Association will be held at Atlantic City, on the New Jersey seashore, on June 5, 6, 7 and 8, 1906. Owing to the many additions to the membership of the association now being made, as well as other evidences of increased interest in the association work, it is confidently believed that all previous records of attendance will be broken. It is the intention to provide a suitable hall for such exhibits as may be made by the manufacturers and supply dealers who are members of the association. Atlantic City at that season of the year is most attractive, being all furbished up for the summer business, which begins with a rush one or two weeks later. It is understood that no particular hotel will be made headquarters, and that the sessions will be held on the pier. Due announcements will be made. Mr. G. F. Porter will, as usual, be the efficient master of transportation.

NOVEL LABOR AGREEMENT.—President W. C. Gotschall, of the New York & Portchester Railroad is anxious to avoid any conflict with the labor unions and wants to make everything sure, pending the final action which it is hoped the Board of Estimate will be able to take on January 26, as to the awarding of the franchise. To prevent strikes during the construction of the New York & Portchester Railroad, the road's management and a committee of the Central Federated Union are negotiating for an agreement for three years on the same basis as the agreement between the Rapid Transit Commissioner of the Central Federated Union and the Rapid Transit Contractors' Association. The latter agreement covered all the work in the building of the subway until it was completed. The agreement between the central body and the contractors for the construction of the subway was drawn up after a general strike had taken place some time after the work started, and enabled the contractors to complete it much sooner than they would otherwise have done.

CURING SEASICKNESS.—A curious chair invented by Dr. C. Brendal, of Tchupcakowka, Russia, has recently been under test on the Hamburg-American liner *Patricia,* plying to New York, and on the English Channel steamer *Peregrine.* It is described in the *Scientific American.* The invention consists essentially in making the movements of the ship when pitching, rolling, heaving, and setting less felt by the passengers, by providing special chairs, couches, or a whole platform forming part of the deck, and giving to these, either by machinery or by hand, short up and down movements. Consequently, as the long movements of the vessel are thus changed into a great number of short motions, which are constantly interrupted by brief movements in an opposite direction, the causes producing seasickness are counteracted. The device, which is illustrated, consists of a chair with the seat movably arranged with respect to the legs, arms and back. The short up and down movements are given by a small electric motor located between the legs of the chair, and connected by means of a belt with an eccentric actuating the seat. The speed and intensity of the movements can be regulated between considerable limits by means of suitable devices incorporated in the mechanism. A number of passengers, who have tried the device, declare that while they were in the chair, they felt no symptoms of illness, but when no longer using it, the seasickness in some cases at once returned, although not in others.

ST. LOUIS STREET RAILWAYS carried 170,000,000 passengers in 1905, a figure that was only exceeded by 30,000,000 in the phenomenal year of 1904, when the Louisiana Purchase Exposition was held there.

NIAGARA WATER.—At Washington on January 19 Representative Burton, of Ohio, introduced a joint resolution asking for an early report regarding the use of the water flowing over Niagara Falls. The report is requested from the United States members of the International Waterway Commission.

ELECTRIC AUTOMOBILES.—In connection with the two great automobile shows, the New York Edison Company did an effective bit of advertising by directing attention to the facilities furnished by such a central station supply as its own. Nearly all the uptown stables and garages have Edison charging service, and the company itself has no fewer than 50 electric automobiles in use, including runabouts, delivery wagons and trucks.

PORTO RICO BY WIRELESS.—Gov. Winthrop, of Porto Rico, American West Indies, has acknowledged the receipt of the first paid wireless message between New York City and Porto Rico. It was sent on January 6 and received the same night, although owing to an absence of inland facilities it was not delivered at the Executive House until next morning. The message was sent through the Manhattan Beach station of the Atlantic De Forest Wireless Company as a test.

OLIVER UP AGAIN.—In the New York Legislature at Albany, N. Y., on January 19, the distinguished statesman and patriot, Assemblyman Oliver (Dem.), New York, introduced a series of bills, two of which provide for municipal ownership in cities of the first class. He declared that he had introduced these bills when he was in the Assembly in 1898. One provides for city ownership of lighting facilities, the other for that of street railroads, surface, elevated and underground.

CHICAGO MUNICIPALISM.—At Chicago, on January 18, the City Council, in special session, did all it could to advance the municipal ownership plans and passed the rest on to the people. The franchise extension ordinances were laid away to rest, with no chance of an awakening, at least until after the April election. As the traction situation stands now, the voters of Chicago will have to decide irrevocably next April whether or not they want to borrow $75,000,000 and go into the street railway business or leave it to private enterprise, under proper control and regulation.

ENDOWMENT FOR SCIENCE.—By the terms of the will of W. C. Putnam, the Davenport (Iowa) Academy of Sciences becomes prospectively one of the most richly endowed institutions of its kind in this country. Mr. Putnam left an estate of $700,000 with provisions for limited incomes to relatives, the remainder of the revenues to be paid to the academy and the entire estate to go to that institution at the death of the surviving brothers and sisters. His art collection and library, each the most valuable private collection in the State, are left to the academy, with provision for a fire-proof building in which they are to be installed. Mr. Putnam had been a leading financier and business man of Davenport for years.

NOVEL CONCILIATION.—The announcement is made that the presidents of the Chambers of Commerce of Troy and Albany have been elected members of the boards of directors of the United Traction Company of Albany. They were, so to speak, made ex-officio members of the board, it being arranged that their successors in the presidencies of the Chambers should succeed them in the board of the United Traction Company. The Delaware & Hudson Company recently purchased absolute control of the United Traction Company of Albany, partly, it was understood, for the purpose of forestalling keener competition between the railroad and the suburban electric lines of the United Traction Company. To maintain harmonious relations with the public, the railroad company has included these two representatives of the business interests of Troy and Albany who may be expected to present the public's side of all questions which may come before the board of the United Traction Company. It will be interesting to see how this plan works out in practice.

ELECTRIC FREIGHT HAULAGE.—The Massachusetts Electric Company is preparing to enter the freight and express business and has secured the consent of various cities and towns between Fall River and Boston and many on the North Shore. It has now taken the matter before the railroad commissioners for their approval. On the South Shore, Brockton alone will give the Old Colony Street Railway Company a large express business in the shipment of leather from Boston and Fall River to the Brockton factories and the reshipment of shoes to both cities. On the North Shore the Boston & Northern Company can effect a large saving in the transportation of its coal from tidewater to its power houses instead of paying heavy freight rates to the Boston & Maine Railroad. There are also prospects of a large and remunerative business awaiting the inauguration of a general freight and express service on the North Shore.

WIRELESS STATION AT SEAGATE.—The Marconi Wireless Telegraph Company has announced the opening of a new station as a part of the gatehouse at Seagate, the summer resort at the northern end of Coney Island. Outside it is a mast 150 ft. high, from which the wires are strung, and which lead into the operating room. The station is connected with all points in the United States by telegraph lines, and the Marconi apparatus is of the latest pattern, and provided with a new attachment to prevent interference by any other wireless system. The station has an effective forwarding range of 200 miles. Its receiving apparatus is capable of handling messages from any distance. The new station forms the final link in the chain of stations whereby all the big Atlantic liners are in communication with shore uninterruptedly for between 60 and 70 hours from their New York docks. Incoming vessels first get into touch with Cape Race, Newfoundland, when 1,500 miles away from Sandy Hook. Before they lose touch with Cape Race they have picked up Sable Island, off the Nova Scotia coast; before dropping Sable Island they have opened communication with Siasconsett, and then they are successively in communication with Sagaponack, Babylon and Seagate. Outgoing steamers reverse this process.

FIVE-CENT TELEPHONES.—Not later than July 1 this year the New York Telephone Company will put in effect a five-cent pay station rate in Manhattan and Brooklyn as against the present pay station rate of 10 cents. The five-cent rate will become operative in both boroughs at the same time, and the only reservation that will be made will be at hotels, where the hotel management itself holds to the present ten-cent rates for service from rooms and apartments. Addressing some 400 local representatives of the Bell system in the New York territory, assembled at dinner last week, Mr. U. N. Bethell, general manager, said: "The great element that has rendered the reduction of rates possible has been the condensation of the New York business by the increased number of exchanges or central offices and the consequent decrease in the distance of the subscriber from his central office. This has tended to reduce the cost of maintenance and has increased the efficiency of the service. Now, regarding opposition companies, I do not want to blind my eyes to the fact that the Bell companies have opposition in many places, but I do not believe the day ever will come when the public will, for any length of time, tolerate the existence of two telephone companies in the field because of the annoyance, and the expense of double service. The only advantage to the public from an independent company is that the independent company makes the older company more regardful of the rights of the public and of the duty the company owes to the public. Since I have been connected with the New York company it has continued to do business just as though it had a competitor on the same block and doing business on equal terms."

FOR A CANADIAN ROAD.—It is stated from Toronto, Canada, that the Temiscaming Railway Commission have recommended the advisability of electrifying the Temiscaming & Northern Railway, which is owned by the government, for the entire distance so far constructed, about 151 miles. It is proposed to obtain the power from the water falls along the line of the road.

MICA IN PERU.—It is stated that several veins of mica have been discovered at Quilca, a small port on the coast of Peru, situated but a few miles from Mollendo, and that a syndicate headed by the firm of Carlos Aramayo has been formed to exploit the discovery. It is thought that the Peruvian mica will bring a high price, as it is almost as transparent as glass and in large sheets.

ELECTRICITY IN SPAIN.—U. S. Commercial Agent Milton M. Price, of Jerez de la Frontera, reports the building of an electric railroad in that section of Spain. He says that there are no railroads being constructed in Andalusia. Some years ago a route was surveyed and estimates made from Jerez to Algeciras to save 100 miles of travel by the present railroad, and another was projected to two cities 40 or 50 miles from here, but no construction company has yet been formed. They are now building an electric tramway from Cadiz to San Fernando, a distance of 10 miles, and it is proposed to run the track around the city of Cadiz. Other Spanish enterprises of a similar character have been noted in these pages recently.

INVESTIGATING UTILITIES.—Marwick, Mitchell & Co., chartered accountants, have been appointed accountants to the committee of the National Civic Federation, which is to make an exhaustive examination in the principal cities of this country and of Europe, in order to determine whether it is profitable for municipalities to own their own public utilities. The investigation will include an examination of the accounts of the principal gas, electric light, water and street railway plants, whether privately owned or at present owned by the municipalities in which they are situated. It is expected that the work will start without delay. The cost of the work is being defrayed by general subscription.

PROTECTION AGAINST GRAFT.—At Albany, N. Y., on January 17 Senator Marks' Anti-Grafting bill was reported by the Senate Committee on Codes. The bill provides that every corporation such as gas, railroad, light, power, telephone, public service, transportation and financial companies must within ninety days after the adjournment of the Legislature file with the Secretary of State a sworn and detailed statement of all expenses incurred or paid in connection with the employment of attorneys, counsel or legislative expenses for promoting or opposing legislation. Senator Marks believes this publicity will prevent lobbying and grafting. The word "grafting" has been stricken out of the measure.

BROOKLYN MUNICIPAL TROLLEYS.—Borough President Bird S. Coler, of Brooklyn, proposed that the city shall make an actual beginning in the matter of municipal ownership of street surface railroads. Mr. Coler plans that the city shall lay and own tracks in Livingston Street, Brooklyn, when that thoroughfare is widened, and lease them for short terms to the local railroad companies. Livingston Street is to be widened to relieve the congestion of travel in Fulton Street. Already the Brooklyn Rapid Transit Company has applied for the privilege of laying and using tracks on the widened street. Mr. Coler asserts that Livingston Street is the "only remaining key to the city railroad situation in Brooklyn." In a letter which he sent to Engineer Nichols, of the Franchise Bureau, he disapproved of the Rapid Transit Company's application and urged that the city construct the road, leasing it for periods of one or two years to any company desiring it.

THE VICTORIA FALLS PROJECT.—In a letter to the London *Times,* Mr. W. B. Esson after discussing some of the controverted points relating to the project for transmitting power 700 miles to the Rand from the Victoria Falls of the Zambesi, concludes that from all of the data so far at hand, there is no reason for believing that the proposal to utilize the falls on an 80,000-hp scale is economically sound, and that its realization would be commercially successful. He estimates at $5,000,000, the cost of a line to transmit 20,000 hp, and at $20,000,000 the line for transmitting 80,000 hp, including provision for spare conductors. The annual cost of the latter would, at 10 per cent, be $2,000,000, while the coal and water bills of a steam station of the same capacity would be $2,217,500.

BURROWING IN BROOKLYN BOROUGH.—Deputy Commissioner of Water Supply Cozier, of Brooklyn, is perfecting a scheme by which the city will be able to give important information to corporations and contractors regarding sub-surface construction in that borough. The plan has been drawn up by Electrical Engineer H. S. Wynkoop. The deputy commissioner says: "Mr. Wynkoop's plan contemplates an expenditure of $150,000 to secure a revenue of $50,000 per annum. It gives information quickly and reliably; it does away with guesswork and enables the municipal engineers to draw their specifications so closely that contractors may submit the lowest bids possible for the actual work to be done; it conserves what little space remains beneath our roadways; it insures the greatest dispatch in opening and closing the streets. Municipal engineers, contractors and corporation officials are united in their advocacy of the proposed plan."

REDUCTION OF PRICE.—With regard to the effect of the reduction in the price of current to 10 cents the kilowatt-hour, a question raised in the *New York Times,* Mr. Arthur Williams, general inspector for the New York Edison Company, produced data gathered by his clerks. Comparisons were made in batches of fifty patrons in different localities. The chief object was to see whether these patrons were adding to their consumption of current. Fifty customers in the East Sixties showed a reduction in the bills amounting to 25 per cent. In another section an increased consumption of 12 per cent was shown, with a decrease in the bills of 19 per cent. Fifty west side houses showed an increased consumption of 11 per cent, and a decrease of 22 per cent in the bills. Another batch of fifty patrons showed that there was less than 1 per cent increase in the use of electricity, and that the decrease in the money paid the company was fully 33 per cent. The New York Edison Company is making good this situation by a vigorous and strenuous campaign for new business, and its reports show a banner month of new contracts in December.

EFFECTIVE JOURNALISM.—Last November we called attention to the spirited manner in which Mr. J. C. Donnell, of the Maryville (Mo.) Electric Light & Power Company, had fought the battle for his company against outside promoters by means of a daily paper of his own publication called the *Gas News.* A recent note from Mr. Donnell says: "In order to round out the work and eliminate completely any further efforts of the kind on the part of the city council and their official organ, I found it necessary to issue a sequel to the *Gas News* and named it *The Searchlight.* One issue of that completely closed up the official organ. Not a word has appeared in that paper since against the light company, and now after waiting thirty days to hear from them I now take pleasure in mailing you a copy of the *Searchlight,* which will, I presume, be the last issue. I might say that we hold the city contract, draw our pay promptly the first of every month and are not afraid of any gas proposition on earth. I might add that the editor of the 'official organ' called at my office after the issue and ordered his private residence wired and equipped for electric lights; also his printing establishment. I find him a very profitable customer." Mr. Donnell is to be heartily congratulated upon the outcome of his plucky and ingenious fight.

The Hydro-Electric Plant of the City of Sofia, Bulgaria.

By FRANZ KOESTER.

FOR supplying electricity for light and power in the city of Sofia, Bulgaria, the water of the river Isker is utilized. The present hydraulic installation is for 2,000 hp, but by tapping the river at a higher point, and installing another conduit, 3,000 horsepower becomes easily available. At the lowest stage of the river it would be possible to store at the upper dam 15,000 cubic meters (5,300,000 cu. ft.) of water. The average discharge of the river is 5 to 6 cubic meters (176 to 222 cu. ft.) per second. The dam is of solid masonry, and is provided with two waste gates, as shown in Fig. 1. A few yards above the waste gates in bulkhead are the two head gates for the supply tunnel, which is 1,100 meters (3,600 ft.) long, 2.50m. deep (8.2 ft.) and 2m. (6.56 ft.) wide.

About 25m. (82 ft.) from the head-gates, there is an overflow in the tunnel, a rack for catching foreign matter, and a discharge gate for emptying the tunnel. The tunnel has an arched roof with straight sides and bottom, being cut to a grade of 2/10 per cent. At the end of the tunnel is a building large enough to accommodate the present penstock and the additional penstock which would be required for the second installation. This water-house contains a waste weir, an inlet gate to the

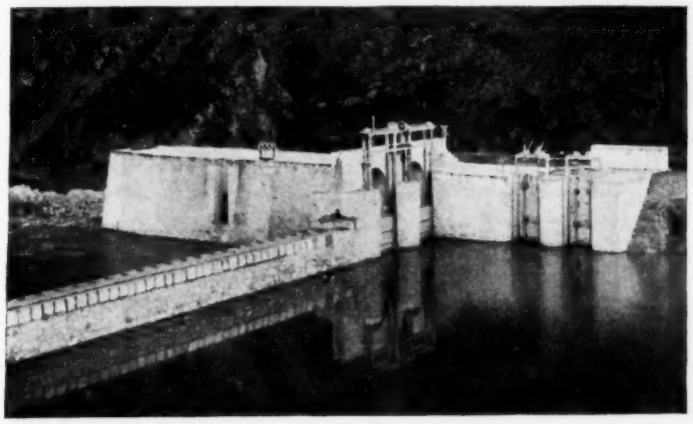


FIG. 1.—DAM AND BULKHEAD.

penstock and a fine rack. The penstock is built especially strong for high pressure and is of riveted steel plates, 5 to 8 mm. (.197 to .305 in.) thick. Of course, the 5 mm. plates are used on the upper end of the penstock where the pressure is least. It is built in sections 6m. (19.6 ft.) long, and 1.4m. (4.6 ft.) diameter. Before the penstock enters the power house it is supplied with a butterfly gate, and enters a manifold, from which branch pipes lead to the turbines.

The power house is located 22 km. (13.7 miles) from Sofia. It is built of birch, and is 12.5x30m. (41x98.4 ft.) and designed to accommodate six hydro-electric units, four of which are now installed. At the side of the power house is a switch-room 4.8x9.9 m. (15.7x32.4 ft.). Near the power plant is a two-story building, the first floor of which is used as a repair shop, and the upper story as the dwelling of the superintendent.

The turbines, shown in Fig. 3, are designed for a working head of 52 to 55m. (170.5 to 180.4 ft.) to use 960 to 910 litres (249 to 236 gallons) of water per second, and at a speed of 400 r.p.m. to develop 500 horsepower, at an efficiency of 75 per cent. They are of the horizontal radial outside discharge type, and are placed on a floor above the basement containing the penstock manifold. The water is conducted up through the main floor and enters the side of the turbine. Draft tubes which conduct the discharge to the tailwater below are well submerged.

This type of turbine, made by Piccard & Pictet, of Geneva, has the advantage of giving uniform power under varying heads of water supply. A cylinder gate between the stationary part and the runner, which controls the speed of the turbine, is water-balanced, so that it operates easily and noiselessly. This may be controlled by hand or by a motor, which in turn is controlled by a centrifugal governor.

Each turbine is provided with a fly-wheel, and is direct-connected to the generator by means of a flexible insulating coupling. The generators, which are of the Oerlikon type, have an output of 425 kw at 400 r.p.m., 53 cycles, 8,000 volts. Each rests on 44 porcelain insulators. The revolving part carries 16 laminated pole pieces. The field coils are made up of 110 turns of 7 mm. copper wire. The stationary armature has 48 open slots, in which are the armature coils, each of 65 turns of 3.4 mm. copper wire, placed in seamless mica tubes. The generator is well ventilated by openings in the frame. As the stationary armature is all cast in one piece, the bed plate is so constructed that the armature may be moved to one side for access to the revolving part.

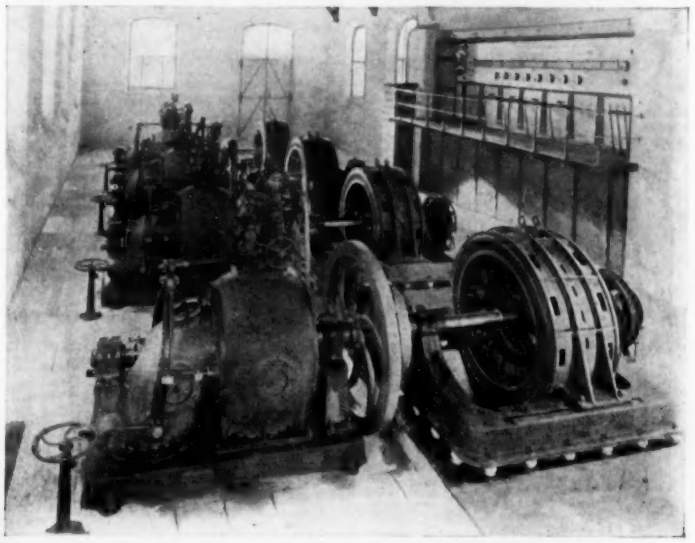


FIG. 2.—VIEW OF INTERIOR OF SOFIA POWER HOUSE.

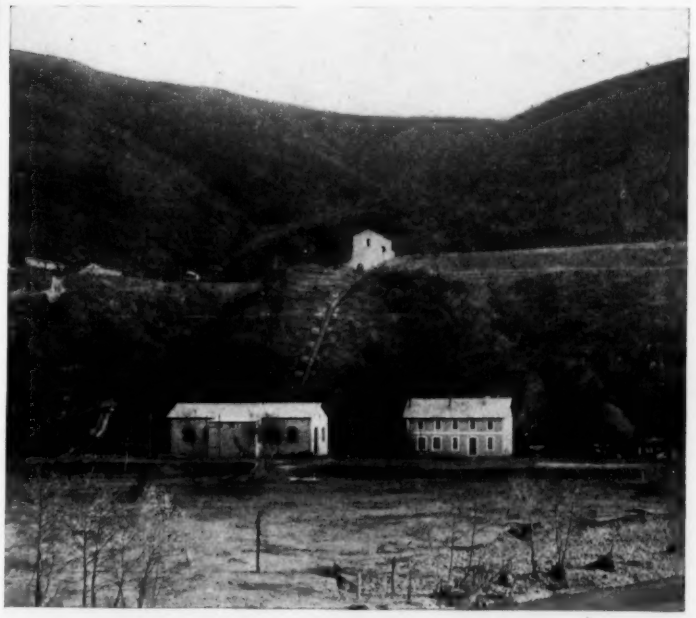


FIG. 3.—POWER HOUSE, PENSTOCK AND SUPERINTENDENT'S HOUSE.

The main shaft bearings are cast on the bed plate. Each generator is provided with its own exciter of 90 kw, 50 volts, mounted on the overhanging main shaft.

Aluminum bars mounted on porcelain insulators conduct the current from the generators under the floor through accessible tunnels to the switchboard. The switchboard consists of an iron frame, having a gallery placed about 7 ft. above the floor, for giving access to the front of the marble slabs which are car-

ried on the upper part of the frame. On the gallery are mounted levers for the switches of the high-tension circuits, both from the generators and for the main line wiring, and also stands with hand-wheels for the rheostats. Above each stand are the necessary switchboard instruments, mounted on the marble slabs. One panel on each side of the switchboard is reserved for the further enlargement of the plant. At the extreme left are the instruments controlling the main line wires, while on the extreme right are the necessary instruments for connecting the generators in parallel, with accompanying phase lamps and voltmeter switches.

The generators work on a ring bus-bar system, Fig. 4, having switches so placed that the cutting out of any generator will not

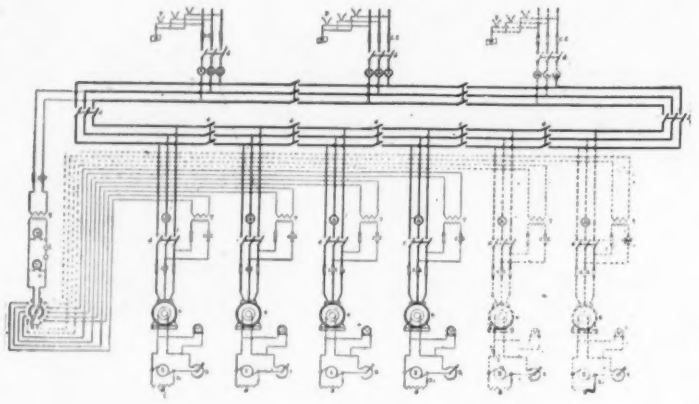


FIG. 4.—BUS-BAR SYSTEM, SOFIA POWER PLANT.

disturb the operation of the others. The entire system is provided with horn lightning arresters.

Both power and lighting circuits consist of 8-mm. wires run on double petticoat porcelain insulators on wooden poles. The whole length of the circuit is 16.2 k m.(10 miles). Around the outskirts of the city is placed a system of transformers with a total capacity of 400 kw for reducing the e,m.f. from 7,200 volts to 156 volts for lighting. The secondary circuits in the city are run underground and are fed from 5 transformer stations of 260 kw capacity, which are supplied with current at 3,400 volts from a main transformer station in the outskirts, where the tension is reduced from 7,200 volts.

The contract for power house, transformer station and the entire electrical equipment was given to the Oerlikon Maschinenfabrik, Switzerland, which built and installed the generators and other electric work, and sublet the masonry and the turbines.

Nitrogen from the Atmosphere.

At the inauguration of the new chemical institute of the Technische Hochschule in Berlin, Prof. O. R. Witt gave some interesting information regarding recent developments in connection with the production of nitrogen from the air by electrical means. According to the *Elektrotechnischer Anzeiger*, the professor said that the greatest progress had been made in Norway, where Prof. Birkeland, assisted by Herr S. Eyde, had developed a commercial method of producing nitrogen, using an arc elongated by a magnetic field and an e.m.f. of 5,000 volts. Experiments were first started with a 20-hp plant in 1903. After experimenting with plants of small size the inventors built the first factory at Notodden in May, 1905. The equipment consists of three furnaces, each consuming 700 hp, and all three combined deal with 75,000 litres (2,650 cu. ft.) of air per minute. Before entering the furnace, the air is mixed with nitric oxide which gives it an intense brown color. After passing through the furnaces the gases are led to stone towers (having a capacity of 8,800 gallons each) where nitric acid is formed. Copper tubes are used as electrodes, being cooled by a water circulation. It is stated that plants of less than 5,000 hp are not commercial; in fact, it would seem that installations of less than 20,000 hp are also doubtful in this respect, even if the power be very cheap.

The Electrical Distribution System of the Public Service Corporation of New Jersey.—III.

(*Concluded.*)

By G. U. G. Holman.

CENTRAL JERSEY.

THE important plant in Central Jersey of the Public Service Corporation is at Metuchen, supplying sub-stations in Rahway, Carteret, Perth Amboy, New Brunswick, Bound Brook and Plainfield. Each of these sub-stations replaced generating plants which in general consisted of countershafting and old type generators with slow speed simple engines, or small units driven from simple high-speed non-condensing engines. The locations of all these plants made it necessary to cart all the coal used at a cost of from 28 to 40 cents per ton, and every one except Bound Brook was obliged to buy water for the boilers.

The Metuchen station consists of two 1,000 kw Curtis-General Electric turbo-generators, 13,200-volt, three-phase, 60-cycle; two S. K. C. 500-kw, 6,600-volt, three-phase, 60-cycle generators, direct connected each to a Pennsylvania cross-compound condensing Corliss engine; three Stanley 50-kw, 6,600-2,300 volts, three two-phase, 60-cycle, oil-cooled transformers; two three-phase, 500-kw, 60-cycle transformers for stepping-up the Stanley generators to the bus-bar 13,200 voltage, and one 300-kw, three-phase, 60-cycle rotary, transforming to 600 volts direct current. There are two 600, one 700, and two 800-hp Climax boilers at 150 lb. pressure.

The transmission pressure from this station is 13,200 volts, local service being carried by 2,300 volts from step-down transformers. The line is most substantial throughout this district, Hemingray insulators being used. The feeders vary in length from 4½ to 9½ miles, and are given two transpositions at one-third and two-thirds the distance covered by each particular feeder. All the feeders are overhead, except those in New Brunswick, which are carried on the stone work of a bridge over the Raritan River at this point, then through a three-conductor steel-armored submarine okonite cable under the Delaware and Raritan Canal which parallels the Raritan River. On the New Brunswick side of the canal the line feeds underground through okonite single-conductor lead-covered cable, each drawn

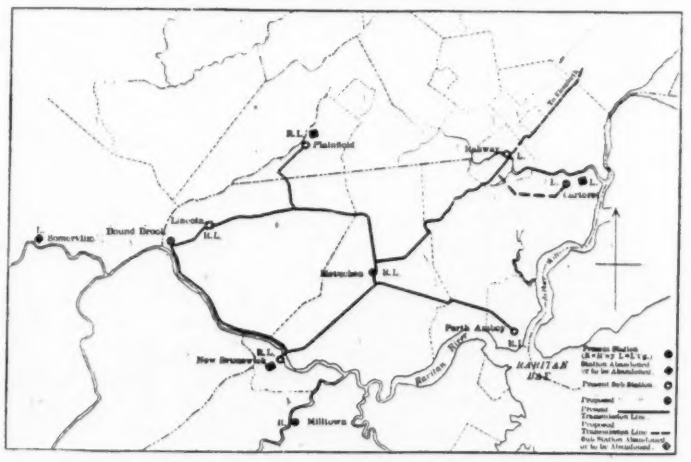


FIG. 1.—MAP OF CENTRAL JERSEY SYSTEM.

in a separate conduit to the sub-station about 550 ft. distant. The whole underground and under-water system is provided with oil switches and in duplicate, thus making it possible to carry the whole load on either set entirely independent of the other in case of accident.

The Carteret station, superseded by the sub-station of the same name, was a non-condensing plant. It did not produce its own steam, but purchased it from a neighboring manufacturer. It consisted of two General Electric generators, of 37½ and 19 amperes respectively, of a voltage of 2,300. The larger generator was direct connected to an Ames Iron Works engine. The smaller generator was belted to the same engine.

The Carteret sub-station is to be fitted up with step-down transformers 13,200 to 2,300 volts, and supplied from the Metuchen station.

The Rahway sub-station contains four Stanley transformers for light and power, 6,000-2,300 volts, three to two-phase, 60-cycle of 50 kw each; and one Westinghouse 200-kw, two-phase, 60-cycle rotary, producing 550 volts direct current for railway service.

The Perth Amboy sub-station contains two General Electric 300-kw three-phase, 60-cycle rotaries, giving 600 volts direct current for railway supply; six Stanley 6,000-2,300-volt, three to two-phase, 60-cycle transformers of 50 kw each for incandescent lighting service; and three General Electric 31-kw Tub transformers for arc light service, 6,200 volts, three to two-phase, 60-cycle. The three to two-phase connection is used to obtain a balance of the transmission independent of the number of transformers employed.

The New Brunswick sub-station contains one 200-kw Westinghouse rotary for light and power, 2,500-volt, two-phase, 60-cycle; two 30-kw and two 50-kw Stanley transformers 6,000-2,300 volts, three to two-phase, 60-cycle; and three General Electric 30-kw., three to two-phase, 60-cycle Tub transformers used for street arc lighting.

The Lincoln sub-station now supplying Bound Brook and vicinity is to be disbanded and moved to Bound Brook. It now contains one Westinghouse 200-kw and one General Electric 200-kw rotary, each of 60-cycle, three-phase, of 550 and 600 volts respectively, supplying railway lines. There are also two Stanley 50-kw, 6,000-2,300-volt, three to two-phase, 60-cycle transformers for supplying light and power; and three 10½-kw, 2,300-volt General Electric static transformers, single-phase, 60-cycle, for supplying incandescent street lighting.

The Plainfield generating station is to be abandoned and used as a sub-station, additional transformers and rotaries replacing existing steam-driven units. These latter now are two 350-kw Westinghouse 1,150-volt, two-phase, 60-cycle generators, each direct connected to a vertical cross-compound Ball & Wood condensing engine; one 120-kw Westinghouse 1,150-volt, two-phase, 60-cycle generator belted to a Westinghouse compound condensing engine; and one 225-kw Westinghouse 550-volt direct-current railway generator direct connected to a Westinghouse compound condensing engine. The present transforming apparatus which is to be added to, consist of two 200-kw General Electric rotaries, three-phase, 60-cycle, for supplying 600-volt direct current for railway use; and two 100-kw General Electric rotaries 6,600-1,150-volt, three to two-phase, 60-cycle for supplying lighting circuits. The boiler equipment to be discarded is of two 300 and two 200-hp Stirling, and two 250-hp Cahall boilers, at 150 lb. pressure.

The Somerville station, about to be abandoned and its circuits taken over upon the new Bound Brook sub-station, consists of two General Electric 90-kw, 1,150-volt, three-phase, 60-cycle belted generators run by a 150-hp Ball & Wood cross-compound non-condensing engine.

The plant at Milltown is entirely a direct-current railway station and is to be retained as an independent station to supply railway feeders. It comprises two Westinghouse 225-kw, 550-volt generators, each belted to an horizontal cross-compound Cooper & Company condensing engine; a 500-kw, 550-volt Westinghouse generator direct connected to a vertical cross-compound Ball & Wood condensing engine; a Bullock 100-kw series booster of 250 volts, direct-connected to an horizontal Ball & Wood simple condensing engine; one Westinghouse 300-kw, 360-volt, 25-cycle generator direct connected to a vertical cross-compound Brown-Corliss condensing engine; and two 50-kw motor-generator sets, one of 550 and the other of 250 volts, used as a booster and getting its energy from the 360-volt, 25-cycle generator. The boiler equipment is six horizontal return tubular 125-hp boilers, at 125 lb. pressure, four made by Currier & Sons, and two by McCabe.

Thus the Central Jersey system, at the moment consisting of five central plants and three sub-stations, will shortly be supplied from two plants and seven sub-stations, and the light and railway plant—Metuchen—will be connected with the plants of the Northern New Jersey system by means of the tie feeders from the sub-station at Rahway to be run to Elizabeth, the latter already being connected with Newark.

In suburban communities with many shade trees and scattered residences as are found throughout the territory supplied by the Public Service Corporation the subject of street lighting and the kind of light to adopt has been and is a problem. The incandescent light is most desired by municipal officials as giving the best distribution of light for the money and surburban places have not the money at their disposal like the cities.

The systems of incandescent street lighting used are various at the present time. There is the shunt-box system using a multiple lamp with the shunt in parallel; the series system using series lamps with film cut-out in the base of the lamp; the series system using a multiple lamp, with lamp as shunt and film cut-out in the fixture; the series system, using a multiple lamp with film cut-out in the socket.

The Junction sub-station, fed from Marion, is a new one, having one 1,000-kw, General Electric, 13,200-volt, 25-cycle rotary, producing 550-volt direct current for railway service.

The Bayonne sub-station contains one 1,000-kw and one 500-kw, General Electric, 13,200-volt, 25-cycle rotary, giving 500 volts direct current, feeding railway lines. There are also four 150-kw, General Electric static transformers, 13,200, three-phase to 2,300-volt, two-phase, for lighting.

SOUTH JERSEY SYSTEM.

The present South Jersey system of the Public Service Corporation consists of the lighting stations at Trenton, at Bristol and at Mount Holly, together with the light and railway plant at Camden and the sub-stations supplied by the Camden plant at Moorestown, Merchantville, Haddonfield, Gloucester and Woodbury. The Gloucester sub-station is only now replacing the old plant at that point.

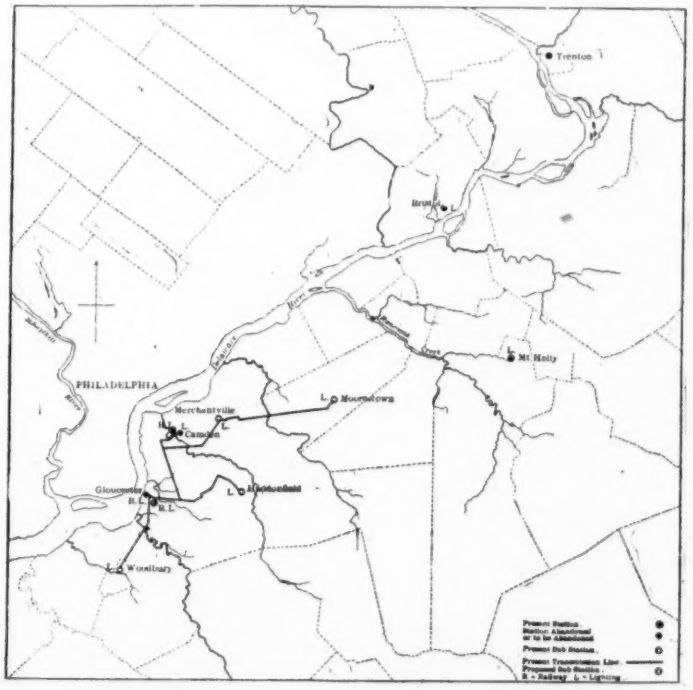


FIG. 2.—MAP OF SOUTH JERSEY SYSTEM.

The plant at Trenton contains three Stanley 500-kw, 2,500-volt, two-phase, 60-cycle generators, each direct-connected to a cross-compound Pennsylvania Iron Works condensing engine of 800 hp; two Northern Engineering 194-kw, 264-volt, direct-current generators, used for power service, each coupled to a synchronous two-phase, 2,400-volt motor, and one Brush arc of 14.8 kw and one General Electric arc machine of 39.6 kw, both belted to a 200-hp, cross-compound, non-condensing Ball & Wood horizontal engine. There is one General Electric, 260-volt, 100-kw, direct-current generator as a spare unit, belted to the Ball & Wood engine. There are four Babcock & Wilcox boilers of 300 hp each,

at 125 lb. pressure, and a Berry fire-tube, 300-hp boiler, also at 125 lb. pressure.

The Bristol plant contains two 60-kw, General Electric; three Westinghouse of 45 kw, 35 kw and 25 kw, respectively, all five 125-cycle, 1,100-volt generators, belted to jack shaft driven by one Westinghouse compound, 100-hp, and two standard Westinghouse engines of 80 and 45 hp. All the engines are non-condensing. The boilers are one Warden return-tubular, 100-hp; one 150-hp Charles Ervien, and one 80-hp Hoff & Fontain.

The Mount Holly station is a 110-volt Edison plant of four 25-kw and two 12½-kw Edison bipolar machines, belted to two high-speed Armington & Sims engines of 80 and 25 hp and an Ames high-speed, 80-hp engine. All are non-condensing. There are two horizontal tubular Centerville boilers of 100 hp each, at 125 and 90 lb., respectively.

At Camden there is a railway plant and a lighting plant, now consolidated into one. The railway end is provided with one General Electric, 200-kw and one Westinghouse, 225-kw, 550-volt, direct-current generator, each belted to one of two vertical cross-compound condensing Ball engines; two Westinghouse, 800-kw, 550-volt generators, each direct-connected to a Pennsylvania Iron Works horizontal cross-compound condensing engine, and one General Electric, 600-amp., 100-volt booster, driven by a direct-current, 500-volt motor on same shaft.

The light and power end contains two 1,000-kw Parsons horizontal steam turbo-generators, 11,000-volt, 60-cycle, three-phase, supplying the sub-stations at Gloucester, Woodbury, Moorestown, Haddonfield and Merchantville. The station also consists of transformers to supply 2,200 volts alternating current for lighting in Camden, and for alternating-current arc lighting. The boilers are six Babcock & Wilcox, of 250 hp each, at 200 lb., for supplying the new turbines; and four 150-hp horizontal Coatesville boilers, at 120 lb., and six vertical fire-tube Berry 300-hp boilers, at 120 lb. pressure. The units just replaced are five 72-kw, Thomson-Houston arc machines; one Westinghouse, 100-kw and one Thomson-Houston, 62-kw, 550-volt, direct-current generators, used for power, and 1,240 kw in ten General Electric, Thomson-Houston and Stanley 1,100-volt, 125-cycle generators. The displaced engines consist of one Cooper 1,000 hp, one single-cylinder, vertical, Corliss, 700-hp; three Westinghouse, compound, 250-hp; two single-cylinder, Buckeye engines of 150 and 250 hp, and one tandem compound, 400-hp, Harrisburg engine. All the engines were belted. The discarded boilers are two 500 and two 200-hp, double-deck, horizontal Coatesville boilers, at 115 lb., and three vertical, fire-tube, Berry boilers of 330 hp each.

The Gloucester plant supplying the railway consists of three Westinghouse, 225-kw, 550-volt generators, each belted to a 250-hp Westinghouse compound engine. Arc lights are run by five Wood arc machines of 25 kw each, belted to a line shaft which is driven by a 200-hp Wetherill Corliss engine.

The sub-station section of the Gloucester plant consists of a 40-kw Pittsburg, 11,000 to 2,200-volt transformer, distributing incandescent lighting.

The Woodbury sub-station has a 40-kw Pittsburg transformer, 10,000 to 2,000 volts for incandescent lighting only.

The Moorestown sub-station contains one Stanley 60-kw, 11,000 to 2,200-volt transformer for incandescent lighting. There are also two constant-current, General Electric regulating coils of 10½ kw each, 60 cycles and 5.5 amp., for series incandescent street lighting.

Haddonfield has two 100-kw General Electric, 11,000 to 2,200-volt transformers. There are also two General Electric constant-current coils of 10½ kw each and 5½ amp. and two constant-current transformers of 60 kw each and 5½ amp., used for series incandescent street lights; also one constant-current General Electric transformer, 7½ amp., for series arc lighting.

The Merchantville sub-station contains a General Electric, 60-kw transformer, 11,000 to 2,200-volt; a constant-current reactive coil, 60-cycle, 10½ kw and 5.5 amp., for series incandescent street lighting; and one 4.4-kw, General Electric compensator, also series incandescent street lights.

In Camden there are two storage batteries on the railway circuits, a 300-amp. battery on Delaware Avenue and a 160-amp. battery at Westmount. Attached to the railway line at Moorestown is a 200-amp. battery.

Some of the plants now under the charge of the engineers of the Public Service Corporation have been in their care for so little time that changes to produce greater economy and more concentration of central power stations have not yet been perfected. There is room for great improvement along these lines to which the engineers are fully alive, so that in a comparatively short time one may expect to see the simplicity of perfection where now the complexity of the present situation is exposed to view.

This account would not be complete without mentioning the fact that the Corporation has its own central telephone exchange with private wires to all its offices, stations and sub-stations, insuring perfect service for intercommunication on company business. The uniform courtesy extended to the writer by the officials and employes of the Public Service Corporation whom he met in his search for information is appreciated and herewith acknowledged.

Burglar Insurance in Dubuque.

L. D. Mathes, general manager of the Union Electric Company, of Dubuque, Iowa, followed up an epidemic of burglary in that city with a circular worded:

"BURGLAR INSURANCE—WE SELL IT."

"Not in the form of a written policy, but something more effective and more dreaded by the Knight of the Dark Lantern. The all-day and all-night service of

"THE MATCHLESS LIGHT."

Then follows a quotation from the article in the November *Ladies' Home Journal*, in which an ex-burglar says: "Other things being equal, a burglar will always pass a house lighted by electricity for one lighted by gas. The reason for this is that houses lighted by electricity are now wired in such a manner that the turn of a switch or the pressure of a button on one floor will illuminate another floor. Then, electrically-lighted houses are much more likely to be equipped with modern burglar alarms. Houses so wired are practically traps for the burglar. He may be working on the ground floor, for example, when some member of the household in a chamber above is aroused and fancies that he hears some one moving about below. At once the man of the house reaches for the electric switch and turns on the light for the lower floor, so that the burglar finds himself in a blaze of light, while the man of the house, a gun in his hand, is screened by the darkness. This puts the householder in a position to shoot without being shot at."

The circular then continues: "The above is of immediate local interest due to the following related occurrence: 'Two K's of the D. L., gentlemanly or otherwise, recently conducted an inventory of the possessions of one of our prominent citizens, appropriating such of the family plate as appealed to their artistic temperament. The spirit of annexation being not entirely satisfied, the nocturnal visitors proceeded to invade the establishment of a second well-known family. The head of the house from a second-story bed chamber was alarmed, reached for the electric button—a twist of the wrist—a flood of light and a hasty get-away, minus booty.'

"This protection is offered to every householder—is also suggested to merchants for the illumination of the subterranean passages in the rear of their stores (more generally known as alleys), and their valuable stocks. The automatic time switch will cut the lights in and out at any predetermined hour. Details and estimates upon application."

Mr. Mathes reports that he has had several inquiries as a result of this circular and has wired the rear of three stores for 16-cp lamps on goose-neck fixtures.

In another circular this company has recently sent out, the announcement is made that arrangements have been completed whereby the Union Electric Company will obtain each month and mail to those interested a limited number of copies of the *Electric City*, published by the Chicago Edison Company as a substitute for *Illustrated Electricity*, the publication of which has been suspended.

Convention of the Northwestern Electrical Association at Chicago.

THE fourteenth annual convention of the Northwestern Electrical Association was held January 17 and 18 in Chicago, instead of at Milwaukee, in order to take advantage of the opportunity to visit the Chicago Electrical Show, now in progress. The sessions were held in the Great Northern Hotel.

President C. H. Williams, of La Crosse, Wis., called the convention to order at 10 o'clock a.m., and after some routine business delivered the presidential address. He called attention to the practice begun this year of having the papers printed in advance for distribution among members that they might have an opportunity for preparation of discussion. It had been the effort of those preparing this programme to restrict it to subjects which were alive and which would assist in bettering the financial results of central station properties. During the last year or two, much effort had been exerted by plants all over the country to develop sales departments. He hesitated to touch upon this subject for fear of getting entangled in the far-reaching subject of rates; but the subject is one of such vital importance that the time is well spent where the facts are gone after and displayed. Results show that education of the people is possible in every community, not only in business places to the use of window display and decoration, but on the streets to the use of electric signs and outlines, and in the homes to raising the standard of illumination. Many managers fail to set a proper pace by neglecting to make their business places and homes a living example of the many unfamiliar uses to which electric service is particularly adapted. How many are there who have an investment of $150 per consumer, including plant and distributing system, who would consider it almost suicidal to spend one dollar per capita in an endeavor to increase the sales per consumer 25 per cent? And again, how many are there who have given the subject a proper and fair trial and found the results unsatisfactory? A large part of the troubles causing interruptions to the service are traceable to defective interior wiring. It might be of direct interest to members to consider the advantages and disadvantages of having municipal authorities take upon themselves the inspection of and responsibility for this work.

At the close of this address the secretary, Thomas R. Mercein, who is also general manager of the Electrical Show, announced that the following day, January 18, had been set aside as Northwestern Electrical Association day, and arrangements made to receive the association as a body.

On Thursday the following officers for the ensuing year were elected: President, Mr. H. Almert, Chicago; first vice-president, Mr. E. B. Kirk, Oshkosh, Wis.; second vice-president, Mr. Frank Baker, Evanston, Ill.; secretary and treasurer, Mr. B. C. Adams, Madison, Wis. Directors—Messrs. Irving P. Lord, Waupaca, Wis.; C. H. Williams, La Crosse, Wis.; Roger N. Kimball, Kenosha, Wis.

The nominating committee expressed the high appreciation of the association for the retiring secretary and treasurer, Mr. Thomas R. Mercein, who had served so faithfully and well for the past eleven years, and suggested that some token be purchased and presented to Mr. Mercein as an appreciation of his efforts in behalf of this association. The board of directors include two past-presidents of the association and one past vice-president, and the nominating committee recommended that in the future the board of directors be made up of the three junior past-presidents of the association. Mr. E. B. Kirk, of the Winnebago Traction Company, represents the electric railway interest in the new list of officers.

In taking the chair President-elect Almert, in a few remarks commended warmly the good work of President Williams the past year. He said the association had gone into a little rut in the past years, and all realized it was necessary to get out of it. The earnest efforts put forth by the president during the past year would be an example to guide future efforts.

Mr. Allen, of Beloit, moved an earnest vote of thanks from the association to the retiring President Williams, which motion was enthusiastically carried.

Mr. Harold Almert, the new president of the Northwestern Electric Association, is manager of several electric light and power companies controlled by a syndicate of Chicago bankers. For three years past he has been manager of the Cicero Light, Heat & Power Company, of Oak Park, Ill., and he is now manager of the Constantine Hydraulic Company, of Constantine, Mich., and of the Three Rivers Light & Power Company, of Constantine and Three Rivers, Mich. He is a Chicagoan by birth and twenty-nine years of age. His education was obtained in high school and manual training school, and as he puts it, "in the school of experience." He took a course in the Chicago School of Applied Electricity, and later acted as instructor of this school for one year. For four years he was in the engineering department of the Chicago Telephone Company, and for four years also was superintendent of water and light for the Lincoln Park Commissioners in Chicago, having in charge the lighting and water supply of the North Side parks and boulevards. For a time he was a sales engineer in the Chicago office of the Buckeye & Jandus Electric Companies. During the time he was filling these various positions he was also fitting himself for his later work by taking a course in the Chicago Law School, of which

PRESIDENT HAROLD ALMERT.

he is a graduate, and in the International Accountants' Society, of Detroit. His election to the presidency of the Northwestern Electrical Association comes as the logical conclusion to the active part he has taken in its affairs for several years past. During the past year he has been a vice-president in that association. Mr. Almert has the combination of engineering ability and the faculty to get acquainted with and secure the confidence of men, which goes to make the greatest success in the work he has chosen.

The papers presented which developed the greatest interest were several on central station business-getting methods, which led to much discussion on that subject. Abstracts of these papers and the discussion will be printed next week together with an abstract of a paper and its discussion on "Modern Underground Construction," by Mr. W. D. Burford.

The first paper presented was that of Mr. Geo. H. Barrett, of La Crosse, Wis., on meters, which in the absence of the author was read by Mr. Irving P. Lord:

THE PROPER HANDLING OF CONSUMERS' METERS.

The author recommended that upon meters being received from the factory, a record be made in a book kept for the purpose, of the manufacturer's and the purchasing company's number, and that then the meters be taken to the testing room and subjected to a reasonably careful test. The label of the back of the meter "this meter has been carefully tested on various loads and found to be correct," does not always mean just what it says. Instances had come under the author's observation where the various connections in the meter were not all properly made, others where essential parts were entirely missing and still others where the meter was so far out of the proper adjustment as to preclude utterly the possibility of a careful test having been made in the factory. These conditions do not exist to any great extent, although they occur altogether too frequently. He therefore urged that each company make its own test of a meter before placing it in service.

The man installing the meter should have an intimate knowledge of the delicacy of the instrument. A hammer should never be used in fastening a meter to its support; proper tools and screws should always be at hand for fastening in place with the least possible jar. As to the location of the meter, central station managers have not given this subject the attention it deserves. Time is lost by meter readers and testers hunting step ladders and carrying them up and down several flights of narrow stairs. No meter should be installed until the wireman completes his work. When placing a two-wire meter on a system having a grounded neutral, great care should be exercised to see that the outside wire is connected to the fields of the meter, for if the neutral in the building becomes grounded, the registration will be low. A new meter should ordinarily give satisfactory results in service for a period of six months, when it should be inspected and cleaned and so far as possible brought to its original condition.

When a customer makes a complaint on the amount of his bill, he should be listened to attentively and unless some reasonable explanation can be given to him by the office man, such for example, as his bill covering a period of five or six weeks instead of the usual month, the complaint should be turned over to the meter department for adjustment. The man to adjust complaints of this kind must be tactful and polite under all circumstances and be able to convince the customer that he understands his business, if the customer is open to conviction. The subject should be discussed with the customer openly and frankly. The previous test of his meter, when and where it was made and the result, should be explained and invitation given to assist in a test. He should be interested in the operation of his meter, but in explanations technical terms and phrases should be avoided as far as possible. Take the cover off the meter and by turning on one, two or any number of lamps and counting the number of revolutions made by the disk in 60 seconds, one can readily tell whether the meter is very far out of the way or not. Having ascertained this, ask the customer to turn on any number of lamps he chooses and tell him from the speed at which the meter is running, the number of lamps turned on. Repeat the test with more or less lamps burning and tell him how many he turned on or off as the case may be. He will immediately take interest in the test and set about trying to catch you in error. Should it be found that the meter is to some extent fast, make a more careful test using an indicating wattmeter or any of the various methods used by the craft.

While the customer is interested, instruct him how to make a rough lamp test of his meter, urging him to do so frequently and to read his meter at least once a week. Show him that it is to his interest to become as familiar as possible with his meter. In a little while he will become convinced that the meter can be relied on, and a good friend of the company will have been made out of what might have become a chronic kicker. The effect of educating complaining customers in this way is not only to get the good-will of that customer, but he will relate his experience to other customers and prevent the spread of complaints on meters.

As to the number of meters taken care of per meter man, one cannot average more than eight or ten meters a day if indeed he can do that much, if he cleans them and gives them any kind of a thorough test at all. With two thousand meters it would therefore require about eight months' time to cover the entire system if a man gives this, his whole time, every day with no other duties to perform. However, in the majority of cases it is not necessary to do more than clean up and adjust for light load. A meter on full or medium load is usually not far from correct. It is nearly always the light load accuracy that gives a manager cause for worry, as the revenue lost from this source alone must be considerable. Cleaning and testing on light load with the aid of an ammeter in the circuit where the load is lighting exclusively should be sufficient and should not occupy to exceed from 20 to 30 minutes. If in addition the meter must be disconnected from the circuit and a careful test made on all loads, the time consumed in the operation will probably be double that which it was in the other case. A system of inspection of meter readings should be made by the manager or in the case of the larger plants, by the head of the meter department. For example, a jewel may become cracked or chipped, which would cause a meter to run slow. This will not be detected by an ordinary bill clerk and meter readings will become less and less until they stop entirely. In too many cases it is not until then that the attention of the meter department is called to the matter. By having someone with a knowledge of meters and their weaknesses scrutinize the bills, this would be avoided. The author called attention to the chances for error by confusion of meter constants. For example, a meter having a constant of two might get into the record book as having a constant of one-half and this error carried along for months or even years. This is another argument in favor of having the man in charge of the meter department inspect the readings each month. There is also opportunity for confusion due to the fact that some meters read in watt-hours and others in kilowatt-hours. Danger of confusion where both classes of dials are used can be avoided by omitting the reading of the first dial altogether, so that all results will be put down in kilowatt-hours.

DISCUSSION ON METERS.

In the discussion of this paper, Mr. W. H. Winter, of Darlington, Wis., recited the recent experience of his company which installed a water power plant in 1896, and took customers on a flat-rate basis, which plan worked very well until the load passed the limit of the water power, and the coal bills begun to eat up dividends. He then described troubles of the company in introducing meters in place of flat rates.

Mr. B. C. Adams, of Madison, thought Mr. Barrett's paper referred more specifically to direct-current meters than to others. A direct-current meter should be tested most often, but the frequency of tests depends largely on the location of the meter and the importance of the service that it handles. He had direct-current meters around the city that did not need to be tested more than once a year, but they should be tested that often. Alternating-current meters did not need to be tested oftener than once a year and should usually run much longer than that. They had meters on their lines at Madison that had tested out just as accurately when they came into the shop after three years as when they were first put on a line. He criticized Mr. Barrett's suggestion of testing meters in place for customers, and thought that meters should be taken into the shop and tested there, inviting the customer to watch the test and bring somebody with him who knew the meter business and who was not connected with the company furnishing the power. A customer can usually be satisfied by such a test.

As to whether on a three-wire meter a 110-volt pressure coil or a 220-volt coil should be used, the General Electric Company uses the former and the Westinghouse Company the latter. He had experienced no trouble with the 110-volt pressure coil, but has had lightning affect the 220-volt coil meter and short-circuit the line. Unless the man that is looking for the trouble knows where these 220-volt meters are, he has difficulty in locating a trouble.

Mr. Kimball, of Kenosha, said his company had saved much time in meter reading by having meters located in the cellar alongside the gas meter so that a man in reading electric meters does not have to go through the houses to closets or attics. In regard to having people read their meters, the Milwaukee Gas Light Company got out a blank for gas users which his company at Kenosha had made use of and distributed to all its customers, especially those whose bills had increased. He found that in every case where customers read their meters every day and kept track of their consumption on these blanks, the difficulty was obviated. Mr. Adams also registered a protest against the difference in dials referred to in the paper. He thought all stations should insist on having kilowatt-hour dials on the meters.

Mr. J. H. Harding, of Laport, Ind., said that on meters reading in watt-hours they had removed the first hand, making all meters read in kilowatt-hours, thereby overcoming the chance for error between the watt-hour and kilowatt-hour dials. He thought that the most important point brought out by the paper was the feature of educating customers to read their own meters and figuring their own bills. They will not kick when they be-

come acquainted with the working of their meters and they grow to have confidence in them. He had very little complaint from customers on meter reading.

Mr. Winter said that it was much easier for customers to read and test their own meters where there was a watt-hour dial for the reason that they can turn on, say, four lights, and by reading the meter at the end of an hour know just what has been used, whereas with a kilowatt dial they have to put on three or four times that amount. In reading meters his company paid no attention to the watt-hour dial.

Mr. B. C. Dinius, of Zion City, called attention to an alleged slowness of commutator type meters operating on alternating-current when heating devices such as curling irons, flat irons, etc., are turned on. No one seemed able to explain this trouble.

At the Wednesday afternoon session the paper by Mr. W. D. Burford on "Modern Underground Construction" was presented, an abstract of which and of the discussion following its reading, will appear next week. This was followed by the paper of Mr. P. H. Korst, of Janesville, Wis., entitled

SUGGESTIONS FOR INCREASING THE POWER OUTPUT OF CENTRAL STATIONS.

Almost all places of 8,000 or more inhabitants now have a day power service and in many of the smaller towns it will soon be adopted. With the increasing use of heating devices and the numerous applications of electric power for residences, stores and shops, it will only be a matter of a few years before every central station will furnish a 24-hour service. A day power circuit is always a benefit and helps a city's growth by making it easy for small factories to start at a low first cost and small operating expense for power, which fact should be brought prominently before the people and newspapers so that they will be interested in pushing the development of the power business.

The usual practice in charging for power is to charge a minimum of $1 per month per horsepower or fraction thereof installed. Some obtain the maximum demand by an instrument such as the Wright demand meter and charge one rate for the first 30, 60 or 90 hours of use per month at the maximum demand, a low rate for all over that. The Doherty method is to make a fixed monthly charge for the readiness to serve, based on the fixed charges of the central station and the size of the customer's installation, and then charge for the power used by meter at a low rate per kw-hour. Others use a modified rate similar to the Doherty or Wright demand methods. Many use the older methods of a minimum rate for the installation with a base price per kw-hour and a sliding scale of discounts governed by the quantity used. There are still a few places that sell power at flat rates. All of these methods have their strong and weak points and none has become so thoroughly in use as to be recommended as the proper method.

Intermittent and small users of power such as residences, dentists, physicians, offices, etc., are usually connected to the lighting meter and pay lighting rates until their power demands warrant a separate meter. It is customary to offer special rate to such customers as use power 24 hours a day and also those whose business is such that it is possible to dipense with the use of power during the hours of peak lighting in winter. Sometimes water plants make special rates to customers which have steam plants and who use electric power only during such portions of the year that there is ample water power. This enables the central station to carry a smaller steam reserve for use during seasons of low water.

Good solicitors employing all or part of their time according to the field for canvassing, are invariably a good investment, and especially in starting new applications in power work, which can be used as an object lesson to other customers. About the first question asked a solicitor is what the power will cost, and often the question is based on an average use of power far above what the actual would probably be. Often it is necessary to install motors for desirable customers for a few months, on trial, to demonstrate the cost of operating. Good judgment and engineering skill should be used so that a good saving of power can be effected by eliminating the wastes due to shaft and other losses, and also obtain the greater convenience, larger and better output with the other numerous advantages of electric, and thereby making a satisfied customer.

It is good policy for the central station to sell and install motors at cost. This keeps the installation cost low and should insure a first class economical motor, put in so as to obtain the best results. Several manufacturers of motors issue books on the applications of motors to various kinds of work, the power needed to drive machines under different conditions and much other useful data to a solicitor. They will also be found ready to give any information in their power to aid in securing a power customer, and when several good jobs are in prospect, will often send a skilled salesman to help land the business.

Judicious advertising always pays. A live newspaper is always a good medium, but a story should be made concise and catchy. Do not try to tell too much at once, but leave something for to-morrow. Well selected cuts help very much to the attractiveness of an advertisement, and many manufacturers will be glad to loan suitable cuts illustrating their products. Circulars, sent to a well selected mailing list and carefully followed up by a solicitor, always bring good results. Many manufacturers gladly send descriptive pamphlets and flyers for distribution and these always bring in inquiries if properly sent out. Since central stations also sell advertising through illuminated signs, they should be liberal advertisers to be consistent and show faith in it.

Heretofore the use of electric power has been largely confined to the smaller factories and printing offices, but it is being rapidly extended to stores and residences. Automatic refrigerators are being successfully employed now in restaurants, meat markets, etc., but there is a large unexplored field for it in domestic use. There is no reason why electric plants cannot obtain as large returns from residences for electricity at power rates, for heating and power use, and battery charging for automobiles, as gas companies now get for fuel gas. Power, in addition to refrigerators, can be used to operate pumps, laundry machines, dish washers, ice cream freezers, ventilating fans, and it is a safe prediction that this will soon become one of the most profitable fields for the sale of current for these purposes and also help largely to solve the vexatious servant girl problem. Another advantage is that residence customers will employ considerable electricity during the day, on Sunday and holidays when the station load is usually low.

The use of small motor-driven air compressors should also be vigorously pushed among barbers and physicians for their special needs, among saloons for charging beer in place of carbonic acid gas, and for other purposes, such as house cleaning outfits, and drilling and chipping metal or marble.

Fans are successfully employed in winter to keep frost off the show windows, and to blow through steam or hot water radiators, thereby increasing their heating capacity, and also to place over hot air registers to start a circulation of hot air when the wind is in a direction that will not let them operate properly. In many cities the power circuits on the outskirts reach some farmers who can be induced to use power for pumping water, shredding corn, sawing wood, cutting feed, separating cream and other uses.

In the discussion of Mr. Korst's paper, Mr. Almert said it is generally recognized that the increase of the use of electric current and power for other purposes is merely a question of the education of the public, but before that is done, it is quite necessary to educate the central station man, who should learn before attempting to disseminate knowledge. Taking the country over, the average central station manager has a very limited knowledge of the various uses of electric power. The present tendency is to consolidate small properties, the effect of which is very good because it gives an opportunity to employ specialists in this class of work, and organize a contract department. The individual small station is generally much handicapped by the limitations of the managers themselves. Another thing handicapping the small stations is the use of obsolete high-frequency apparatus not suited for power. In a meeting of this kind there is usually much enthusiasm over opportunities of increasing business, but the resolutions made by managers at such times are too often like the average New Year's resolution. As Mr. Korst

says, "Keep continuing at the work and finally you will get people to see things in your light."

Mr. Burch, of Madison, said, "we may think we know it all, but a stranger will come into any one of our towns and do more business than we who are located there all the time. The stranger takes nothing for granted, but tries to get customers that we would think it impossible to obtain."

In reply to a question as to whether he considered 125 cycles out of date, Mr. Almert said it was. The change to 60-cycle did not have to be made all at once. The high-frequency transformers will work on 60 cycles with lower capacity and lower efficiency. The machinery now being built in improved forms is all for the lower frequency. High-frequency transformers are usually dry air cooled, and the sooner one gets rid of those the better.

Mr. Kimball, of Kenosha, emphasized the importance of having customers when changing from large steam engines to electric power, to subdivide the source of power and put in several motors rather than one large motor. The tendency on the part of customers is to put in one large motor in order to save in first cost; but the large motor would be apt to be run under-loaded, and with an enormous starting current, making it bad for the central station regulation.

GOVERNMENT TESTS ON FUEL.

C. J. Davidson, of the Milwaukee Electric Railway & Light Company, presented a short paper giving an abstract of results obtained by the United States Geological Survey at the Louisiana Purchase Exposition at St. Louis in 1904, investigating American coals. Following are some of the conclusions of the tests:

(1) The tests in the steam boiler plants of 65 carload samples of coal from 17 states indicate the high steaming quality of American coals and that the quality of many of these coals may be improved by washing.

(2) Most of the American coals and lignites can be used as a source of power in a gas-producer plant.

(3) As indicated by comparative tests of 14 bituminous coals from nine states, the power efficiency of these coals when used in the gas-producer plant is two and one-half times greater than their efficiency when used in a steam boiler plant, or in other words, one ton of these coals used in the gas producer plant has developed on a commercial scale as much power as 2½ tons of the same coal when used in the ordinary steam boiler plant.

(4) Some of the lignites from undeveloped but extensive deposits in North Dakota and Texas when tested in the gas producer and gas engine, have shown unexpectedly high power producing qualities, such as promise large future development in those and other states.

(5) Some of the American coals and the slack produced in mining these coals can be briquetted on a commercial basis.

The author commenting on these says that all of his own investigations for several years have convinced him that while various fads may retard the evolution of the prime mover, that by the law of the "survival of the fittest" the internal combustion engine must supersede any possible type of steam motor.

Mr. J. C. McMynn said that he still adhered to the general statement made at the meeting of the Association in Milwaukee in 1894 to the effect that the cheaper the fuel, the cheaper the steam. The most important point in building a plant is to find the cheapest fuel that can be bought and build the furnace under the boiler to burn that particular coal. There has been a great advance in the last few years in Chicago in burning coal intelligently. There has also been a movement among certain coal men to sell their coal on the basis of the heat units in the coal, which is doing much to help the economical generation of steam.

Mr. Edward H. Taylor spoke of the difficulty of getting the same coal all the time for a steam plant. It is easy for a coal man to substitute one coal for another under an ordinary coal contract. The method his company had introduced was as follows:

After the coal is selected a chemical analysis is made of it, and a contract is drawn in which it is stated that the coal of the sample as delivered corresponds to certain chemical analysis, which is used for the purpose of identifying the coal in the future delivered on this contract. For instance, take a certain coal which costs $2.30 a ton, and the test shows 13,000 B.t.u., moisture 10 per cent and ash 8 per cent. The contract is drawn on the basis of $2.30 per ton, but if the coal varies in heat units the price is to vary accordingly. The following is the method of determining the B.t.u. Take the original B.t.u. of the coal, 13,000, and if the moisture is 10 per cent, deduct 1,300, which would leave 11,700, which would make the commercial B.t.u. of the coal as delivered. Now multiply that by 2,000 lbs. to the ton, which would give 23,400,000 B.t.u. per ton. As the price is $2.30 divide the number of B.t.u. per ton by that to find the B.t.u. for a cent per pound. Add the cost of removing the ashes at 50 cents a ton, making the basis of the contract in this case about 100,000 B.t.u. for one cent. On a 5,000-ton contract an analysis of the coal is made once a week. The sample is taken by the regular method and analyzed and reported to the consumer, and the contractor. If the B.t.u. for one cent is lower than 100,000, the price drops accordingly, and the price always bears the same proportion to the original contract price. The city of Chicago has canceled all outstanding contracts and let them on this basis, to the amount of 200,000 tons.

Mr. W. B. Jackson, of Madison, thought everyone should appreciate the advantage of knowing what the coal is doing. Similar work to that being done in Chicago and Minneapolis is being done by most of the large companies in the East, although not in such a systematic manner.

Mr. Kimball thought that the common standard of quantity of coal used per kw-hour was not the proper basis for judging the qualities of the coal, nor was it fair to the coal man. He found the best basis to figure on was the amount of water which can be evaporated with a dollar's worth of coal.

Mr. Dinius said that in making coal tests he determined the cost of evaporating 1,000 cu. ft. of water, which was then reduced to pounds of water, the final result being the cost per 1,000 lb. of water evaporated. The test was easy to make at any time.

Mr. Kirk said that in the traction power house at Oshkosh he had put in some stokers and immediately on getting them in operation they evaporated about 25 per cent more water, but for some reason the water per kw-hour immediately increased about 15 per cent. He had not yet been able to test the steam for moisture. He did not know but the moisture might have been carried over, due to the intense heat from the stokers. Mr. Kimball thought this a question of boiler design and steam space. Mr. Kirk was evidently forcing his boilers harder with the new stokers than he had before.

THE ECONOMY OF COMBINED RAILWAY AND LIGHTING PLANTS.

Ernest Gonzenbach, of Sheboygan, Wis., took up Wednesday afternoon in a paper on the subject of the saving to be effected by combining railway and lighting service in one power plant as compared with operating separate plants. He said it was rather unfortunate that at the present time most of the combined railway and lighting plants which are in operation are the result of consolidations of two or more corporations which originally had independent existences. The natural result is a lack of uniformity in the producing plant which time and the natural wear and tear of apparatus alone can eliminate. In too many cases we see a power station equipped with separate generators and engines for lighting and railway loads although the two sides are generally combined in the boiler room. Such plants are not getting the benefits of the best economy possible by combining the service, although the arrangement may be unavoidable where business will not warrant putting in new uniform equipment. One of the little economics which has an important bearing in this case is the fact that in the railway plant the heaviest loads occur during the summer months, July and August, which are the months of least activity in the lighting department. The lighting force can give some help to the railway force during the busy summer season and receive help during the winter season of heavy lighting. The amount of idle investment in a railway power station is not as great as in the lighting plant, but nevertheless a considerable amount of equipment has to be held in reserve to take care of the excessive loads which occur on perhaps 15 Sundays and holidays during the warm months. He gave typical load curves taken from actual daily averages of a plant in a small city which approximate closely the usual conditions in any city between 30,000 and 50,000 population.

A summer load of the lighting system has its peak between 9 and 10 p. m. amounting to 625 kw. This curve gives a lighting load factor of 29 per cent. Another curve shows a lighting load for the same plant during a day in December. The peak comes between 5 and 6 p. m. and amounts to 1,140 kw. This curve has a load factor of 40 per cent. A railway load curve on a typical winter day has its peak at 5 p. m. which amounts to 500 kw. Its load factor is 44 per cent. The winter lighting and railway peaks where they overlap give a resulted peak of about 1,600 kw. Another curve represents a typical railway load on a summer holiday when the peak occurs at 2 p. m. amounting to 950 kw. Another at 5 p. m. of 740 kw and a third at 8 p. m. of 500 kw. A smaller peak occurs at midnight. These peaks are due to park travel. The load factor of the combined summer curves is 53 per cent, and of the combined winter curves only 28 per cent. The lighting load represented in the curves was with a connected load of about 40,000 16-cp lamps including a number of stationary motors and city street lighting. A calculation is given showing that the cost of separate lighting and power stations would be $337,500, while a combined plant would cost only $250,000. Besides this saving in first cost, the saving in cost of operation is very considerable. One chief engineer only instead of two is required. There are only half the shift engineers required which would be necessary under separate operation, and the same rule holds true down the line as far as the coal passers. It is safe to say that the cost of labor will be about 33 1/3 to 60 per cent less in a combined plant than it is under separate operation. In addition to the saving in labor the fuel economy is decidedly improved. In a lighting plant boilers and engine work under disadvantageous conditions, as a rule, during light loads. The engines may be only partly loaded, therefore not giving their maximum efficiency. The same holds true of boilers. In the combined plant above referred to it is possible to so operate that there will always be a full load on one or more of the units. This gives the maximum efficiency. Data taken from a plant of this kind now in operation show that the saving in labor and fuel economy amounts to about $6,000 per annum, over and above the operating cost of separate plants. Add to this the $8,750 saving in interest and depreciation and we get a total of nearly $15,000 per annum saving accomplished in a plant of the capacity and dimensions referred to.

There are to-day a number of well designed power stations which supply lighting and power from one class of generators, and there seems to be no reason why the type of units in the power station of this class may not be identical at least within the limits outlined above. The direct current for the railway operation may be supplied through either motor-generator sets or through one or more combination sets consisting of alternating and direct-current generators connected together, and connected with a clutch coupling to the engine. The latter is a much more economical plan, as during light loads the railway generators may be operated from the alternating-current machines working as synchronous motors, thus reducing the number of prime movers in operation and giving a very high demand factor.

The operation of direct-current railway units from synchronous motors taking their current from lighting generators is being accomplished to-day and will be still more in the future. A Tyrrill regulator on the lighting lines will counterbalance any tendency to fluctuation caused by the railway load. A comparatively small storage battery will accomplish wonders in the way of regulating the fluctuating demand on the railway generators, and will enable both classes of service to be furnished from one machine, besides reducing the amount of railway apparatus which must be held in reserve.

Mr. Korst described briefly a water power plant owned by his company at Janesville, which has both 550-volt and 250-volt generators which can be run in series for railway work or in parallel on the three-wire lighting and power system.

Mr. Jewett stated that at Marion, Ind., the electric light company is operating satisfactorily two 500-kw steam turbines, either or both of which are run in parallel with a 400-kw Stanley inductor alternator driven by a Russell engine, all being 60-cycle machines.

Mr. J. M. S. Waring cited an instance at Milwaukee where railway and lighting plants were operated together and a storage battery has been installed which can be connected either to the railway bus-bars or to the direct-current lighting bus-bars. In a test he had made on the Metropolitan Elevated Railway power station in Chicago, it was found that in January, 1905, when batteries were in service the output had increased 25 per cent for the 24 hours over January, 1904, when there were no batteries, while the boiler hours had decreased about 10 per cent.

Mr. R. N. Kimball, of Kenosha then presented a paper on

THE STATION LOAD FACTOR AS A FACTOR IN THE COST OF OPERATION OF CENTRAL STATIONS.

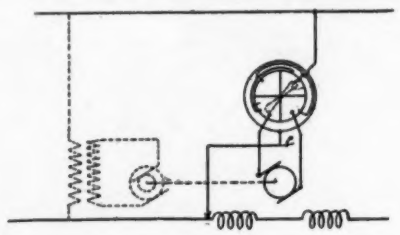
The load factor very largely affects the cost per unit of output in any power plant. Three definitions were given as follows: The true load factor is the ratio between the average load and the maximum. The station capacity factor is the ratio between the average load and the rated capacity of the station. The engine factor is the ratio between the average load and the normal rating of the engine in question. In the writer's experience, boiler economy, unless the boilers are overloaded over 50 per cent, is not affected by the boiler being run underloaded except when underloaded to a large extent, when their radiation losses, which amount to about 5 per cent of the total full-load losses, make them a factor to be considered. Such low load conditions seldom exist in practice, as there are generally enough boiler units so that boilers may be cut out when not needed. In the average small station of under 500 hp a minimum number of men is employed consisting of an engineer and a fireman on each shift. Under these conditions, the cost of labor is constant and the cost per unit varies with the output. The improvement of the load factor lies almost entirely in the new-business department, as the engineer is powerless to do anything but change the engines to suit the varying load conditions and keep the engine factor as high as he can with the equipment furnished. If the station operates for lighting only, great improvement can be made in the load curve by starting a power circuit. In this connection, it it is always advisable to put in small motors whenever possible rather than large ones, especially if they are starting and stopping frequently.

In Kenosha the load factor is lower during the winter than during the summer because they have considerable factory lighting during the months of November, December and January. The motor business and street lighting overlapping with the incandescent load makes a high peak and a low load factor. Curves were given for a cross compound Buckeye engine direct connected to a 220-kw alternator with the engine running condensing and non-condensing. Because they have a heating plant in Kenosha, they operate non-condensing during the winter and condensing during the summer. From the curves given, the author figured costs. The maximum range of the engine running condensing is much better than running non-condensing, so that the condensing engine is more economical with varying loads. Experience shows that better relative economy can be obtained by overloading engines than by underloading them, while the reverse is true of boilers up to the limits before mentioned. As an example of the application of a price sheet given it is assumed that the plant made in 24 hours 2,640 kw. The maximum load was 220 kw, the average load 110 kw; the load and engine factor 50 per cent. The cost of this power according to the writer's figures would be $42.24. If the same number of kw-hours was delivered at 100 per cent load factor, the cost would be $25.54, or at 75 per cent load factor, $30.62, or at 25 per cent load factor, $73.13. In Kenosha with the same equipment as last year the writer's company is selling approximately 100 per cent more energy, and the increase in income and profits well repaid the company for its study of load curves and load factors.

In reply to an inquiry Mr. Kimball said that they started a motor circuit where there had been none before, and as the times had been good, the factories had been running overtime, and not having sufficient power, he had been supplying their long-hour business, which work gave a very good load. They formerly had a station with 140-cycle machinery and at first did not want to put in a new station until they knew they could get power load. They put out a solicitor but he did not sell any power. Then they put in the plant anyway with very satisfactory results.

Quadrant Electrometer as a Wattmeter.

In order to overcome the disadvantage incident to the use of a resistance placed in the "work-circuit" for the purpose of producing a potential difference to be applied to the quadrants of an electrometer when it is used as a wattmeter, Mr. Ernest Wilson, of London, England, according to a patent issued January 16, would obtain the potential for the quadrants from a secondary system affected by the flux produced by the work circuit. The inventor describes several methods for accomplishing this purpose, one of which is illustrated herewith. A small dynamo is driven at constant speed in a field produced by the current in the work-circuit, the armature of the machine furnishing to the quadrants through a commutator and brushes the necessary potential difference which is proportional to and in phase with the current in the work-circuit. The arrangement illustrated is applicable to the measurement of watts in direct-current as well as alternating-current systems.



QUADRANT ELECTROMETER AS A WATTMETER.

First Annual Convention of the Electrical Salesmen's Association.

The first regular meeting of the American Electrical Salesmen's Association was called for January 20, at the Grand Pacific Hotel, Chicago. This association was organized at Peoria, Ill., in October, 1905, and since that time about two hundred salesmen have affiliated.

The morning session was held behind closed doors. In the absence of Mayor Dunne at the afternoon session, City Prosecutor Taylor delivered an address of welcome. President Vincent Gray followed with a paper setting forth the purposes of the association. This paper was in substance that which appeared as a letter in the Electrical World and Engineer, December 23. The main purposes of the organizeation as outlined by President Gray, and as printed on the programmes of the meeting, were "fraternalism, uplifting of the standard of salesmanship, and the general advancement of the electrical interests."

At the conclusion of President Gray's address Mr. J. Robert Crouse, Jr., read a paper and addressed the convention urging the members to co-operate with the electric lamp manufacturers in their efforts to increase the demand for lamps, and in general to increase the demand for current supplied by central stations. He stated that the lamp manufacturers had raised $10,000 and that a similar amount had been secured from another source to be spent in increasing the demand for lamps. A 1 per cent increase in the number of lamps in service, he said, meant an increase in sales of 400,000 lamps per year. To operate the increased number of lamps 34,615 hp of machinery would necessarily be installed and this meant the sale at $125 per hp of $4,326,875 worth of wachinery.

Mr. Crouse related an incident illustrating how the salesman in his travels could encourage the use of electrical apparatus. While staying at a hotel in Pittsburg recently, he learned that a short time before an oil cigar lighter had exploded, and an employee of the hotel narrowly escaped injury. Mr. Crouse had the story of the accident written up and sent to the technical press. The papers in turn sent the story to the manufacturers of electric cigar lighters. In this manner a relatively small incident was employed to further the sale of electrical goods.

Following the address of Mr. Crouse, a paper entitled "Modern American Meter Practice," by Mr. R. C. Lamphier, superintendent of the Sangamo Electric Company was read. The paper described at some length all of the watt-hour meters that have been used in America to any extent.

It was deemed advisable by the committee on by-laws and was afterwards decided by the convention to drop the word "American" from the name of the association, making it the "Electrical Salesmen's Association. The convention also decided favorably on the suggestion of the committee that representatives of the electrical journals be eligible for membership. In regard to initiation fees and dues, it was decided to charge an initiation fee of $1 and annual dues of $2.

Another suggestion of the committee on by-laws that received the hearty support of the convention was a clause prohibiting the use of intoxicating drinks at any function of the association.

A committee consisting of Messrs. J. S. Corby, Francis Raymond, and J. A. Campbell was appointed to confer with Mr. Crouse in regard to devising methods of co-operation between the Association of Lamp Manufacturers and the salesmen, to promote the use of electric lights and other electrical apparatus,, supplied with current from central stations.

After much debate it was decided to hold the next meeting in Chicago, on the first Saturday following the first Monday of the Electrical Show.

The meeting closed with the election of officers. President Gray and Secretary George H. Erich retained their positions and C. R. Wood was elected vice-president for the ensuing year.

New Telephone Patents.

SEMI-AUTOMATIC EXCHANGE SYSTEM.

The semi-automatic telephone switchboard has been attracting considerable attention recently. For years engineers have been familiar with the advantages and disadvantages of the manual switchboard, as compared with the ideal automatic, and on the other hand we have had sufficiently good automatics to learn their primary weaknesses. Between these two extremes lies the hope of many, the semi-automatic, with the rather simple signalling of the automatic, and with manually-operated connecting cords. A patent has just been issued to A. T. M. Thomson, of London, for a rather simple and comprehensive system. The calling party sets dials upon his call-sending apparatus, incidentally winding up a spring for driving the contact wipers which effect the call, and in, and setting an indicator to show a legend "Exchange Called." At the same time a call lamp lights at the switchboard. The operator responds by plugging into the answering jack, extinguishing the lamp and tripping the sender so that the call set upon the calling sender will be transmitted to and registered upon a number receiving mechanism of the pair of cords being used. When the number appears, an operator inserts the calling plug corresponding, in the jack of the called subscriber. No time is lost in waiting for the call to be registered, as the answering cords are associated together upon one keyboard, and number-receiving devices and calling cords are upon another keyboard. Therefore one operator is concerned only in responding to lamps by plugging in, while the other operator merely responds to number signals. Both have the additional duty of clearing lines. The clearing-out signal appears first at the calling line, and upon disconnection of the cord from that line, a disconnect signal is given to the calling operator. Automatic ringing is employed, and the operators have no cause to talk to the subscribers. If a signal fails for any reason, the calling operator may attempt to get it by starting the subscriber's sender a second or third time for a repeat. Throughout the call the subscriber's indicator instructs him of the state of affairs, indicating "Call Received," "Busy," "Talk," etc.

EXCHANGE APPARATUS.

A combined drop and relay, the patent for which has been assigned to the American Electric Telephone Company, has been invented by A. Carliss, of Chicago. The coil occupies the

usual horizontal position, pole pieces being provided at the two ends which extend upwardly toward the horizontal armature. This armature carries a drop latch as a forward extension. Beneath the armature is a sensitive contact spring which gives way under the pressure, to close an auxiliary contact.

A new relay has been patented by C. L. Goodrum, of Rochester, N. Y., a side view of which is shown in Fig. 1. The design is almost self-evident. This relay is very simple and should be reliable. The coil is mounted by a bolt passing

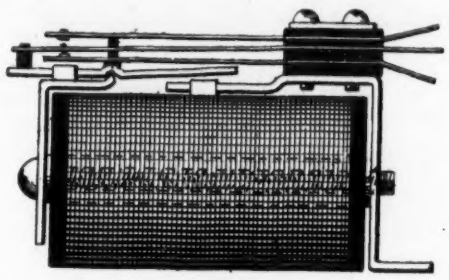


FIG. 1.—GOODRUM TELEPHONE RELAY.

throughout the length of the core, the latter being tubular. The armature is prevented from lateral sliding by insulating pins which act as stops for the outside springs and which engage notches in the armature.

TRANSMISSION CIRCUIT.

Fig. 2 shows a circuit arrangement for a telephone set which has been patented by H. A. Judge, of Washington. It will be seen that an extra coil is included in the circuit. This coil is of high inductance and as the current attempts to vary in it in

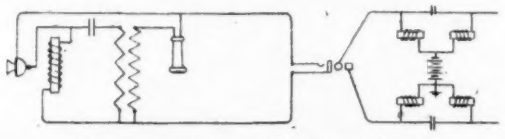


FIG. 2.—JUDGE TRANSMISSION CIRCUIT.

response to the transmitter resistance variations the inductance of this coil produces various assisting and resisting "picks," which, it is claimed, improve the transmission and amplify the effects.

SUB-STATION DEVICES.

K. A. Poyas, of Los Angeles, has brought out a special receiver for the use of linemen of automatic systems. This is the ordinary receiver with two strap keys built into it responsive to exposed buttons. The strap of each key normally closes the talking circuit, but may be depressed on the anvil. This latter and each strap is provided with a flexible cord terminating in a spring clip. With such an apparatus, one can manipulate the switching devices of any line.

A rather novel magneto bell has been patented by E. R. Hollis, of Lamar, Colorado. The armature is suspended by flat flexible steel springs. These springs are secured to a yoke which is movable in a manner to vary the air-gap, and also in a manner to give a normal bias to the armature.

LETTER TO THE EDITORS.

Speed of Machine Telegraphy.

To the Editors of Electrical World:

SIRS:—I notice that in your issue of December 9, 1905, you quote from the *Journal Télégraphique* a tabular statement of "Speeds of various telegraph systems." So far as the figures regarding the Morse, Hughes and Baudot are concerned, they are not seriously wrong, as they are ordinary working speeds obtainable under practical condition; but there is nothing in the table to indicate that the figures quoted for several new telegraph systems are merely experimental and expositional, and not practical working averages. On the other hand, the figures given for the Murray automatic system are less than half of what it can achieve under similar favorable circumstances. The Murray system has reached a speed of 150 words a minute, and with particular difficulty a speed of 120 words (720 letters) per minute in each direction (duplex) can be attained; while a speed of 100 words (600 letters) per minute in each direction is obtainable with ease over long distances. This speed is in daily use with the Murray system between London and Edinburgh. Of course it is well known to telegraph engineers that maximum figures for telegraph systems, such as those published in the table referred to, are utterly misleading, and that speeds of more than 600 letters a minute in each direction simultaneously are of no practical value to telegraph administrations under present day conditions.

Some of your telegraphic readers may be interested to learn that the Murray automatic system is in regular daily work handling commercial messages between London and Edinburgh, and that the British Post Office is having a complete duplex installation of the system constructed for London-Dublin. The practical working trials of the apparatus in Germany are not yet concluded. Russia has ordered an equipment for two circuits, and the apparatus is shortly to be installed in Russia, probably between St. Petersburg, Moscow and Odessa. The Austrian telegraph administration has ordered a trial set to work between Vienna and Prague, and the Indian Government is having a complete duplex installation of the system constructed for Calcutta-Bombay, a distance of 1,230 miles.

LONDON, ENGLAND. DONALD MURRAY.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Brush Contact Resistance.—NANDI.—An account of experiments made in Glasgow University on the contact resistance of carbon brushes. With a current density of 20, 15, 10 and 5 amp. per sq. in. he found a brush resistance, per square inch of brush area, of 0.05, 0.125, 0.13 and 0.31 ohm, respectively. Arnold found the contact resistance of carbon brushes for current densities of 50 to 30 amp. per sq. in. and peripheral speeds from 1,200 to 2,400 ft. per minute to lie between 0.023-0.04 ohm per sq. in. of contact. Both these sets of experiments prove that with carbon brushes the contact resistance decreases rapidly with increasing current density. "Knapp says take an armature and put it into a lathe. On starting the latter and turning on even a moderate current the brushes will be seen sparking badly, although the same armature running in its own field and doing full work will run without sparking. From this he concludes that the presence of a field is necessary to prevent sparking. On this he bases his theory of commutation of current. From the results of the experiments related in this article it is clear that full-load current may be sent through an armature with carbon brushes, rotating away from its field, without causing destructive sparking. This points to the fact that 'contact resistance' and not 'the reversing magnetic field,' is mainly responsible for commutation of current, at least in machines with carbon brushes."—Lond. *Elec. Eng.*, January 5.

Wave Shapes in Three-Phase Transformers.—CLINKER.—The author formerly investigated by means of the oscillograph the effect of a star connection in excluding triple harmonics from the magnetizing currents of transformers. In the case of delta connection, triple harmonics circulate within the closed delta and may be regarded as induced currents set up by a slight triple-frequency flux in the cores. The author has now investi-

gated the effect on the triple-frequency component, due to a gradual change in three steps from delta to star connection. Diagrams are given showing the increase of the magnitude of the triple component.—Lond. *Elec.*, January 5.

Three-Phase Transformers and Wave Shapes.—Field and Dykes.—Three communications illustrated by diagrams giving supplementary notes to the recent article of Clinker.—Lond. *Elec.*, December 8 and 15; January 5.

Permutators.—Menges.—A communication referring to an old German patent of his of 1882 which is interesting in connection with the construction of the modern "permutator," which was recently described in Electrical World and Engineer.—Lond. *Elec.*, December 29.

Lights and Lighting.

Electric Arc.—Stark, Retschinski and Schaposchnikoff.—An account of an experimental investigation, some results of which are as follows: The voltage drop in the column of the arc is greater in an atmosphere of hydrogen than in one of carbonic acid. With copper electrodes the difference is greater than with carbon electrodes. This phenomenon is due to the cooling effect of the electrodes and of the arc. There is a very great difference between the cathode drop and the anode drop in the mercury arc, which indicates a great difference between the speed and the mass of the positive and negative ions inside of the arc. The cathode drop in the mercury arc with the cathode of mercury is independent of the current. The anode drop depends upon various factors and increases somewhat with the current. The results obtained by the authors are in agreement with the conclusions of the ionic theory of the arc.—*L'Eclairage Elec.*, December 31 and January 6.

Power.

Chicago.—A report to the Mayor and Council of Chicago on the most advantageous municipal uses of power from the hydraulic development of the Chicago Drainage Canal for which construction work is now in progress. The report is signed by the city electrician, the city engineer and the commissioner of public works and states that the most desirable use of the power would be for the operation of municipal street railways, which can consume all the power that the sanitary district can furnish for 24 hours each day. Second, power could be used for the lighting of the city streets and the municipal buildings, provided disposition can be made of the power during such hours when lighting is not required. Sewage-pumping stations, bridges and other minor utilities may be equipped for electrical operation, but would not to any appreciable extent serve to utilize during the day time the released power used for electric lighting during the night. It is not economical or practicable to change the present water works plants to electrical operation. New proposed plants may be electrically operated, and careful consideration should be given to this matter before new designs are decided upon.—*Western Elec.*, January 13.

Electric Equipment of Factory.—A fully illustrated article on the electric equipment of the works of J. Hopkinson & Company at Huddersfield, making a specialty of steam fittings. There are a 275-kw and a 150-kw direct-current dynamos, delivering current at 220 volts. The group-system of driving has been adopted in the iron and brass departments where each line of shafting is operated by a slow-speed motor through a chain drive. The motors are both the shunt and compound-wound types, and include six of 20-hp, one of 12-hp, 10 of 10-hp, and one of 5-hp.—Lond. *Elec. Rev.*, January 5.

Artificial Furnace Gas.—Richards.—In a continuation of his serial on metallurgical calculations the author deals with Mond gas and water gas, numerical examples being given.—*Electrochem. and Met. Ind.*, January.

Gas Engine.—A description with detailed drawings of the Oechelhauser gas engine, using producer or blast furnace gas. Lond. *Eng'ing*, January 5.

Gas Power.—Hooghwinkel.—An abstract of a paper on the generation of electric power from the waste gases of blast furnaces and from coke-oven gases. The latter method is considered to be very promising.—Lond. *Elec. Rev.*, January 5.

Traction.

Electrification of French Railway Lines.—An illustrated article on recent developments on the Paris-Orleans suburban line which first adopted electric traction for the tunnel road between the old terminal at the Quai d'Austerlitz to the new one at the Quai d'Orsay. Recently the same company has doubled its lines from Paris to Bretigny, a distance of 20 miles, but electric traction has been for the present limited to the Paris-Juvisy section. The third rail is used with a voltage of 600, three-phase current being transmitted at 5,500 volts and converted into direct current in three sub-stations. Since the trains take a current amounting to as much as 1,500 or 2,000 amp. for starting, the third rail has been given a high conductivity. It consists of a mild-steel flanged rail, weighing 100 lb. per yard, along which are placed, for the greater part of the distance, two lengths of mild-steel rails, fitted fish plates and forming counter rails; the latter weigh 50 lb. per yard. The three rails are bolted together every three metres. They are in 22-metre (72-ft.) lengths, and are electrically bonded at each joint by four flexible copper bonds, 220 square millimetres (0.34 square inch) in section, two being for the third rail and one for each counter rail. In order to increase the conductivity of the return circuit the track rails of the neighboring main lines for steam traction are electrically bonded as well as the tracks for electric traction; junction boxes are mounted along the track in the usual way. The company now owns eleven electric locomotives and five motor cars, the construction of which is illustrated. The electric locomotives are fitted with four 270-hp motors, each driving an axle by gearing, and capable of giving a speed of 43.5 miles an hour to a 200-ton train. Series-parallel control of the motors has been adopted. The motor cars are equipped with four 125-hp motors, one being mounted on each axle, the multiple system of control being used.—Lond. *Eng'ing*, January 5.

Brake.—An illustrated description of an electric railway brake with hydraulic release made by the Allgem. Elek. Ges. Fig. 1

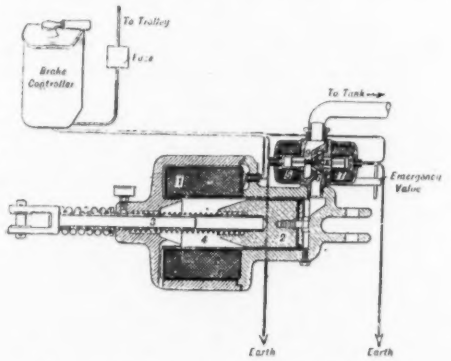


FIG. 1.—ELECTRIC RAILWAY BRAKE.

shows the brake electromagnet in section and indicates the connections generally. When the handle of the small brake controller is moved to the "on" position, current is enabled to flow through the main coil, 1, and the plunger, 2, and the rod, 3, move to the left against the action of a helical spring, thus causing the brakes to be applied. As soon as the desired braking effect has been attained, the large valve, 6, is caused to be closed by sending a current of short duration through the solenoid, 5, the current through the main coil, 1, being interrupted at the same time. The plunger piston, 2, cannot return because the liquid, which was previously drawn into the cylinder past the valve, 6, is now entirely enclosed. Hence the brakes remain "on" without loss of energy for any length of time. If it is desired to release the brake by degrees, current impulses are sent through the coil, 7. This causes the small valve, 8, to lift momentarily, and a small quantity of liquid is able to flow from the brake cylinder back into the tank. The brakes are thus released quite gently. In order to release the brakes rapidly, a current of longer duration is sent through coil 7, and the large valve, 6, opens and lets the liquid escape quickly. The brake, it is stated, weighs only 260 lb. and the small controller has a weight of some 30 lb.—Lond. *Elec.*, December 29.

Electric Traction in England and United States.—A long editorial on a report of Fell, the chief officer of the London County Council Tramways, who recently paid a visit to America. He calls attention to the development of interurban lines in the United States while in England they are as yet few in number and not particularly prosperous. The reasons are restrictive legislation and the protection of vested interests. "The standard of track and paving maintenance in America is very poor. 'Disgraceful' is Mr. Fell's word for some of the cities, and he adds, 'it would not be tolerated here.' This strikes another note of difference. In America the street railway is indispensable, the good paving of a street a quite secondary matter. Here [in England], even in the best managed towns there is a large public which considers the tramway a nuisance." The operating expenses in London per car-mile compare pretty well with those in New York. The earnings per route-mile of electric lines in London amounted last year to $100,390, while in New York the figure was $87,140. The Boston subway and the traffic organization in connection therewith come in for considerable commendation. "The American may learn from us in the collection of fares. Nothing strikes an Englishman as more curious than the 'fare indicator' in a New York car. No tickets are issued, the conductor works the indicator for every fare he collects (that is, he should), and is responsible for so many 5 cents as the fingers point to. Naturally he cannot be sure of getting every fare on a crowded car, much less can the company be sure of getting every fare he takes."—Lond. *Elec.*, December 22.

Single-Phase Locomotive.—Some notes on the tests made by the Swedish railway authorities with single-phase traction on the Tomteboda-Värtan line. Of the experimental track only 3¼ miles are ready at present, but about as much more are under construction and later on more additions will be made. The trolley wire is a round 0.325-in. hard-drawn copper wire, and is suspended at a height over the rails of 15 to 18 ft. Since one object of the experiments is to determine the most suitable method of wire suspension, many different kinds of suspension have been used on different parts of the track. In all cases the insulation is double, there being one insulator between the pole and the span and cross-bar and one insulator for the message wire. The return current passes through the rails, but these are not provided with rail bonds, except on a small part of the line. This arrangement is made in order to test whether at the high voltage used (up to 20,000) rail-bonds will prove necessary or not. A telephone line runs along the line on the trolley poles. Some experiments regarding influence of the railway current have shown that the static influence is considerable, the voltage of the telephone line to ground amounting to about 4,000 volts in some cases. In order to correct this, two discharging coils were connected between the two telephone wires and ground. These removed the static charge, but the telephones are provided with high-tension insulation. A description is given of the locomotive of the Siemens-Schuckert Company which was noticed recently in the Digest.—Lond. *Elec.*, January 5.

Temperature Rise in Switches.—SCHOEPF.—In connection with a paper on automatic train control, the author communicated some tests on temperature rise in pneumatically-operated electric switches. He also emphasized the flexibility of this system and the power which can be concentrated in a small space, in the turret controller where the switches are operated from a pneumatic cylinder, connected thereto by means of a lever, as well as in the rectangular controller where the switches are connected directly on to an extension of the piston rod. In either of these controllers the switch closes with a quick and steady motion, the contact pieces first closing at or near the top, and as the piston rod moves forward the contacts roll and slide one on the other, finally resting at the heel and under the full pressure of the air against the piston. This motion between the switches has the effect of keeping the contact pieces perfectly clean, with the result that the carrying capacity of the switch is always a maximum. The temperature tests shown in the curves of Fig. 2 were obtained upon a switch having contacts 1 in. in width and with various pressures on the contact. The piston was 2.75 in. in diameter, and the several pressures on the contact were obtained by varying the pressure per square inch of the compressed air admitted to the cylinder.—Lond. *Elec.*, December 15.

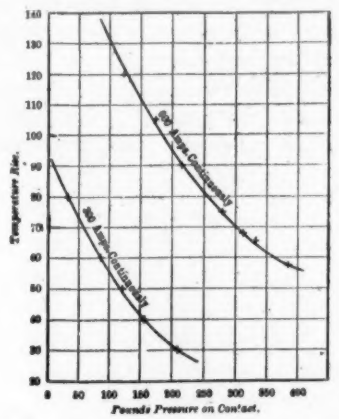


FIG. 2.—CURVES OF TEMPERATURE RISE.

Point Controller.—An illustrated description of the Tierney-Malone point controller for tramways. The point-moving mechanism consists solely of two solenoids and the frame carrying the push-bars. Either solenoid is energized, according to the direction in which the driver has to take the car. The solenoids derive their energy from the trolley wire through permanent cables, which are laid in one of the usual ways from the points to the nearest pole, and thence are carried up the pole to a pair of contacts which are attached to, but insulated from, the trolley wire at a convenient distance, say 40 to 50 ft. from the points. Every trolley head is provided with supplementary contacts which are insulated from the head and from each other. From them run insulated wires to a switch on each platform. The contacts on the trolley are placed so that they can clear frogs, switches and crossings.—Lond. *Elec. Rev.*, January 5.

Train Weight and Acceleration Units.—MAILLOUX.—A further communication explaining his preference for the 2,000-lb. American ton. As acceleration unit he uses, with the present American units, the mile-per-hour-per-second and with the metric system the kilometer-per-hour-per-second.—Lond. *Elec.*, December 22.

Installations, Systems and Appliances.

Aluminum Fuses.—SCHWARTZ AND JAMES. An article giving some notes on aluminum fuses. Aluminum, zinc and cadmium are highly electropositive to copper and brass, and in the presence of moisture this contact difference of potential is likely to give rise to corrosion of the contacts with consequent increase of contact resistance and impairment of the fuse. For damp situations, these metals are, therefore, not suitable for fuses, but a good plan to overcome this difficulty would be to coat the contact clips of the fuse blocks with tin.—Lond. *Elec. Rev.*, January 5.

Lead Poisoning by Electrolysis.—An editorial under the title "A New Calumny," referring to the case, recently mentioned in the Digest, of alleged lead poisoning due to electrolysis of a water pipe by an electric stray current. It is claimed that no proof whatever has been given for that statement. The service pipe affected ran out to a dead-end and could by no possibility whatever form part of a return circuit for stray currents. The whole of the corrosion took place on the inside of the pipe.—Lond. *Elec. Rev.*, January 5.

Electrochemistry and Batteries.

Electrolytic Copper.—ADDICKS.—A paper giving a concise review of the electrolytic copper refining process. In American refineries high-grade anodes are universally used, containing from 98 to 99.5 per cent of copper. The cathode copper is exceedingly pure, usually running about 99.93 per cent copper, with hydrogen as the chief impurity. Objectionable cathode impurities are of two classes—those which decrease the electrical

conductivity and those which make the metal brittle. Arsenic and antimony represent the first class; tellurium and lead the second. Good cathode copper should show but a few thousandths of a per cent of arsenic and antimony. The various items making up the tank resistance are analyzed.—*Electrochem. and Met. Ind.*, January.

Edison Accumulator.—A note discussing the probable formula of the active nickel material in the Edison accumulator. It seems now to be established that the nickel electrodes of alkali accumulators contain only hydrated Ni_2O_3, and not any peroxide NiO_2, for whose existence there is no proof at all.—Lond. *Eng'ing*, January 5.

Lead Accumulator.—Peters.—An account of results of some tests of the Climax accumulator. Its special feature is the positive pole electrode which is characterized by segments pressed out of a cast lead plate by means of a kind of knife by a special machine.—*Centralbl. f. Accum.*, January 1.

Storage Batteries.—Broekman.—A paper read before the Dublin section of the (Brit.) Inst. Elec. Engs, discussing various points of the construction of storage batteries and their use in central stations. He highly recommends the introduction of board diaphragm separators acting as a complete screen between plates of opposite polarity. Some remarks are made on the use of end-cells, boosters, etc.—Lond. *Elec.*, December 29.

Units, Measurements and Instruments.

Measuring Self-Induction.—E. and W. H. Wilson.—An illustrated description of a method for the measurement of self-induction. The arrangement is shown in Fig. 3. R is the resistance whose self-induction is to be found, shown as a straight

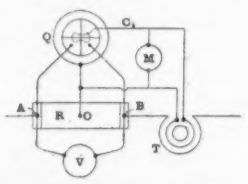


FIG. 3.—MEASURING SELF-INDUCTION.

shunt. Q is a quadrant electrometer, whose quadrants are connected to the terminals, A and B, of the resistance, R, and whose "case" is connected to a point, O, midway between A and B when the best accuracy is desired, but which can be connected to either A or B with accurate results when the potential difference between A and B is small compared with that between the "needle" and "case" of the electrometer, Q. T is an air-transformer whose primary coil can consist of a single turn of stout wire when large currents have to be dealt with. (In the experiments of the authors six turns were employed for large currents and 246 turns for small currents. The secondary of this transformer consisted of 40,000 turns of copper wire, having 5,000 ohms resistance, and was the secondary of an induction coil.) One end of the secondary circuit is connected to the "case" of the electrometer and the other to the "needle." M is a multi-cellular voltmeter connected between the "needle" and "case" of the electrometer. V is a hot-wire meter which can be used to measure the current in the circuit when the resistance, R, is a suitable shunt; but, if more convenient, an ampere-meter can be placed in the circuit. It is necessary that the electrometer should obey Maxwell's law under the conditions of the test. Adopting Maxwell's symbols, C is the P.D. between the "needle" and "case." A-B is the potential difference between the quadrants. C is supplied by the secondary circuit of the air transformer, and is in quadrature with the current in its primary circuit. If x be the current in the circuit, then the potential difference, Rx, will produce no movement of the "needle" if the electrometer is a true wattmeter, since it is in quadrature with C. If L be the coefficient of self-induction of the resistance, R, and f the frequency, then for a simple harmonic current $2\pi fLxC$ will be measurable on the instrument if it has sufficient sensibility, and is equal to ΘK where Θ is the deflection and K a constant. The constant, K, is found by impressing known voltages between the needle and the case and between the quadrants, and noting the deflection Θ', in which case K will be equal to the product of the voltages divided by Θ'. If alternating voltages are employed, the power factor as between them must be unity, or direct voltages can be used with convenience. In order to find L it is necessary to determine the frequency, f, the amperes, x, and the volts, C. Virtual values can be used. Results of some tests of this method are given.—Lond. *Elec.*, January 5.

Magnetic Testing of Cast Iron by the Permeability Bridge.—Campbell.—An account of an investigation undertaken to determine a suitable method for testing bars of widely-different magnetic properties by means of the Ewing permeability bridge. This instrument is primarily intended for the comparison of bars of nearly the same quality, errors being introduced if the sample to be tested has a very different permeability from the standard. In order to get over this difficulty, which is encountered particularly in the case of cast iron (the curve for which differs in form very considerably from that of the usual soft-iron standard), the author utilized a number of different standard bars of various degrees of magnetic quality, and compared each successively with the cast-iron bar, using the bridge only to determine the points where the permeabilities were equal in each case; that is to say, where the B/H curves of the sample and standard in question crossed. This was done by keeping the number of turns on both branches equal and varying the current till a balance was obtained, thus eliminating entirely the error due to inequality in the magnetizing forces. In order to carry out effectively this method of crossing points, a large number of standards were required, and this magnetic quality had to be progressively graduated. In order to fill in the gaps which would exist with the use of ordinary materials, the author used, in some cases, tubes of the same external diameter and measured their apparent permeability. The curves for the series of standards were obtained by the usual double bar and yoke method, and in some cases corroborated by ballistic tests of rings. The method has been used with great success over a long series of tests, carried out at the British National Physical Laboratory.—Lond. *Elec.*, December 22.

Bureau of Standards—Reichsanstalt, Etc.—A note giving the following data on the amounts granted by Germany, Prussia, France, the United States and England to their national institutions for physical and engineering testing and research.

Country. Name.	Cost—Bldg.	Cost—Eqpmt.	Annual grant.	Receipts for work, annual.	No. of tests.	Staff.
Germany, Reichsanstalt	$1,000,000		$80,000	$10,080	$18,951	80
Aichungs-Kommission		240,000	42,500	...	...	..
Prussia, Versuchsanstalt		687,500	75,000	45,000	5,000	140
France, Laboratoire d'-Essias	135,000	100,000	27,500	...	...	12
U. S. A., Bureau of Standards	350,000	225,000	95,000	570	1,666	58
England, National Phys. Lab.	95,000	...	27,500	29,715	28,183	50

In Germany and Prussia the State takes the fees; the above Reichsanstalt fees are for the year 1900. The receipts of the Bureau of Standards given above are for the first year. The receipts and the number of tests of the British National Physical Laboratory include the Observatory Department. The building cost of the British National Physical Laboratory given above is in addition to buildings standing on the side; a further grant of $25,000 has been received for this year, and a memorial has been extended to the Chancellor of the Exchequer on behalf of the Laboratory regarding the subject of an additional State grant to the institution; it is signed by 150 members of Parliament.—Lond. *Elec.*, December 22.

Osmium Lamp for Photometric Comparisons.—Revessi.—An account of experiments made to determine the value of the osmium lamp as a secondary standard. The author tested two lamps of 37 volts and 25 cp which were connected for 70 days in a circuit in series with a low resistance. Every day the lamps were connected to a storage battery and photometric tests were made. It was found that with constant current the cp first increases and reaches 103 per cent of the original value after 200 or 250 hours; it then slowly decreases, and after 800 hours is 97.6 per cent and after 1,680 hours 96.9 per cent of the original value. At constant voltage the cp increases during 200 hours

to 106.7 per cent and then decreases until it is 98.2 per cent after 800 hours and 93.2 per cent after 1,680 hours. These results show that it is preferable to use constant current. The variation in this case during 900 hours is 0.7 per cent, and is smaller than with any other secondary standard lamp. The resistance of the osmium filament reaches a minimum after 500 hours. The moment of maximum cp at constant voltage is therefore not identical with the moment of minimum resistance. It is probable that in the filament first a charge occurs in the metal itself and after that a decrease of the cross-section.—*Zeit. f. Beleucht.*, December 30.

Standard Cells.—HULETT.—An abstract of an Am. Phys. Soc. paper on electrolytic mercurous sulphate as depolarizer for standard cells. Such cells have now been under observation for about two years, and it appears that the cadmium cells have been exceptionally constant, as variations of single cells are not over two parts in 100,000. The Clark cells are not so constant since they show variations of about 5 parts in 100,000, disregarding the temperature variations due to the generation of gas at the zinc amalgam. A serious difficulty with Clark cells has been their great tendency to crack at the zinc side; but this may be avoided by allowing the platinum wire to extend well into the leg of the cell and cover it except at its point with a thin sheet of glass. The ratio of the voltage of the Clark cell at 15° C. to the cadmium cell at 20° is 1.4067; the ratio for the two cells at 18° is 1.4033, at 21.1° 1.3997 and at 25° 1.3949.—*Phys. Rev.*, January.

Transmitting the Readings of Thermometers to a Distance.—MARTINY.—An article illustrated by diagrams and giving a summary of the principal systems which have been developed for this purpose.—*Elek. Anz.*, January 4.

Testing Motors.—CARTER.—A description in detail of the arrangements for the commercial testing of small motors up to 15 hp.—Lond. *Elec.*, December 29.

Telegraphy, Telephony and Signals.

Tuned Wireless Telegraphy.—SLABY.—The concluding paper of his long serial on the tuning of wireless telegraph transmitters. Coupled systems have always two waves, one being the first harmonic of the other. Indirect excitation should be applied if in tuning, the higher harmonic is to be used; direct excitation is preferable with the use of the fundamental wave. To obtain the best action at a distance, the mutual common self-induction of the oscillating circuits must have a certain, although small, value. The whole transmitting system is to be considered as one unit like an electric generator. The law which is valid for all electric generators with constant e.m.f. that the useful outside work is a maximum if it equals the internal loss in the generator (efficiency equal 50 per cent) holds good for the transmitting system in wireless telegraphy, as has been proven by the experiments of the author—*Elek. Zeit.*, December 21.

Wireless Telegraphy.—ERSKINE-MURRAY.—A paper read before the Glasgow section of the (Brit.) Inst. Elec. Eng. The author gives a summary of recent developments in wireless telegraphy and describes various systems. To explain the propagation of electric waves round the curve of the earth's surface, he assumes that the spreading of the waves into space is prevented by a highly conducting layer high in the atmosphere so that the waves travel round the earth much as if between two parallel conducting planes. The correctness of this hypothesis is questioned in an editorial note.—Lond. *Elec.*, December 15.—The author replies to the criticisms in a letter of Lond. *Elec.*, December 29.

Syntonic Wireless Telegraphy.—HEDDINGER.—An article illustrated by diagrams discussing the limitating factors of syntonic wireless telegraphy.—Lond. *Elec.*, December 22 and January 5.

Miscellaneous.

Expiring British Patents.—A table giving a list of the more interesting British patents which will expire during 1906. Among them are patents, covering Hutin and LeBlanc's amortisseur; Lundell's spherical continuous-current motor; Lundell's method of speed control of an electric motor by providing two armatures and two field windings; the use of non-arcing metals in lightning arresters by the Westinghouse Company; Mathiesen's arc lamp regulating mechanism; Felton and Guilleaume's type of paper-insulated telephone cables, and interlocking armoring; Willson's electric smelting of refractory ores; DeLaval's flexible shaft for turbine wheels; Schmidt's superheater; Diesel's internal combustion engine known by his name; the Oechelhaeuser two-stroke gas engine; and Parsons' method of governing steam turbines by admitting steam in puffs, the duration of which is regulated by the governor.—Lond. *Elec.*, January 5.

Zeit. f. Elek.—The name of the *Zeitschrift für Elektrotechnik* (Vienna) has been changed into *Elektrotechnik und Maschinenbau.* The scope of the paper has been enlarged so as to include subjects of mechanical engineering. The journal continues to be the organ of the Vienna Electrical Society and of the Austrian Association of Central Stations. The abbreviation of the name to be used in the Digest in future will be *Elek. u. Masch.*

Mineral and Metal Production in 1905.—The annual statistical tables on mineral and metal production in the United States in 1905. The total on-metallic production had a value of $777,849,418, against $642,912,777 in 1904; the total metallic production was $706,765,872 in 1905 against $491,888,362 in 1904. The largest advances of metals are in iron from 16,276,641 long tons ($225,268,711) in 1904 to 23,010,625 long tons ($382,666,694) in 1905, and in copper from 817,715,005 lb. ($106,320,950) in 1904 to 925,267,840 lb. ($145,257,798) in 1905.—*Eng'ing and Mining Jour.*, January 6.

Adjusting the Direction of a Searchlight on Board Ship.—DUBOIS.—A detailed illustrated description of a method of adjusting the direction of a search light from a distance by electrical means.—*L'Industrie Elec.*, November 10.

Electric Chime.—HOPKINS.—An illustrated description of its construction.—*Scientific Am. Supplement*, January 6.

BOOK REVIEWS.

DYNAMO DESIGN. Its Theory and Practice. By A. Press. New York: McGraw Publishing Company. 102 pages, 28 illus. Price, $2.00.

This small volume is a very interesting and suggestive contribution to the theory of design of direct-current machines. It would seem as though little could be added to the large number of books extant on this subject, but the work of Mr. Press is original in many respects and full of such suggestions as will put thoughtful designers to thinking, even though these suggestions may not always be right or be backed by proper experimental evidence. The book is divided into seventeen chapters, treating of the armature diameter and length, ratio of pole enclosure to pole pitch, the armature iron and copper losses, the working densities in the iron and copper, the slot shape, design of the commutator, and the determination of the sparking and heating constants. In reading through the various chapters we cannot but admire the many pretty and original ideas which the author develops more or less fully, but we also are filled with regret that so many premises are accepted without carefully investigating their foundations, thus introducing a somewhat uncritical attitude where the greatest care should have been exercised in testing the assumptions upon which the calculations are based. While brevity is generally an advantage, too much brevity is decidedly objectionable in chapters of such intrinsic complexity as those on commutation and sparking, and such conditions as the brushes covering more than one bar; and the mutual induction of the coils, under commutation, upon each other, should have been investigated and commented on. The theory of commutation is the author's specialty and it would have been easy for him to present the subject in such a manner as to make it not only attractive, but also comprehensible and useful to the designing engineers. Diagrammatic representations of some of the differential equations used would also greatly enhance the value of Mr. Press's theory.

To illustrate our point of view in criticising some of the author's methods, let us turn to Chapter XI on "Armature Self-Induction," which commences as follows:

"In determining the armature self-induction the following formula can be employed:

$$\text{Self-induction per ampere turn per cm. length of imbedded conductor} = \frac{.38\ (p+6)}{\sqrt{q}}$$

in an authoritative manner as though there could be no doubt about its truth, whereas it is altogether erroneous and without any experimental foundation. If the author's great talent for theorizing had been chastened and tempered by the fire of solid experience he would have used more discernment than is shown in some of his assumptions. While these crudities disagreeably jar upon the experienced designer studying the book, there are so many good features which compensate for this defect that we feel safe in saying that the reader of the little treatise will receive suggestions which will prevent any feeling of disappointment produced by a certain easy-going spirit of taking things for granted which should be proved by facts and experiment. The book is one in which all intelligent and thoughtful designers of direct-current machinery will be interested and from the study of which they will receive useful suggestions.

Elektrische Kraftubertragung. By Wilhelm Philippi. Leipzig: S. Hirzel. 386 pages, 4 plates and 32 ills.; paper. Price, 18 marks.

This substantial volume is addressed by an engineer to engineers. It treats of the practical achievements of electric power transmission and distribution in Germany both by direct and alternating currents. Formulæ are given for many of the important data occurring in such installations. Applications are described, and abundantly illustrated, to hoisting, elevators, cranes, tool and machine driving, boring, ventilating, and work in factories and farms. The book is excellently adapted to the needs of students who have become acquainted with the nature and action of dynamo machinery and who seek to become acquainted with its practical applications. The book will also be a useful reference for engineers on the subject of practical utilization of power transmission over short distances.

Instrumente Zur Messung der Temperature fur Technische Zwecke. By Otto Bechstein. Hannover: Gebrüde Jänecke. 64 pages, 61 ills. Price, 1 mark.

This pamphlet is very clearly and interestingly written from the engineering standpoint. The theory of operation of the apparatus is not deeply entered into. An illustrated description is merely given of the various types of thermometers and pyrometers in industrial use. These are in brief, gas thermometers, liquid thermometers, maximum-and-minimum thermometers, recording thermometers, pyrometers, calorimeters, optical pyrometers, thermo-electric pyrometers and electric-resistance thermometers.

A final section deals with the manipulation of thermometers in general and the relative advantages of different types.

The engineer will find the pamphlet of interest and value.

BOOKS RECEIVED.

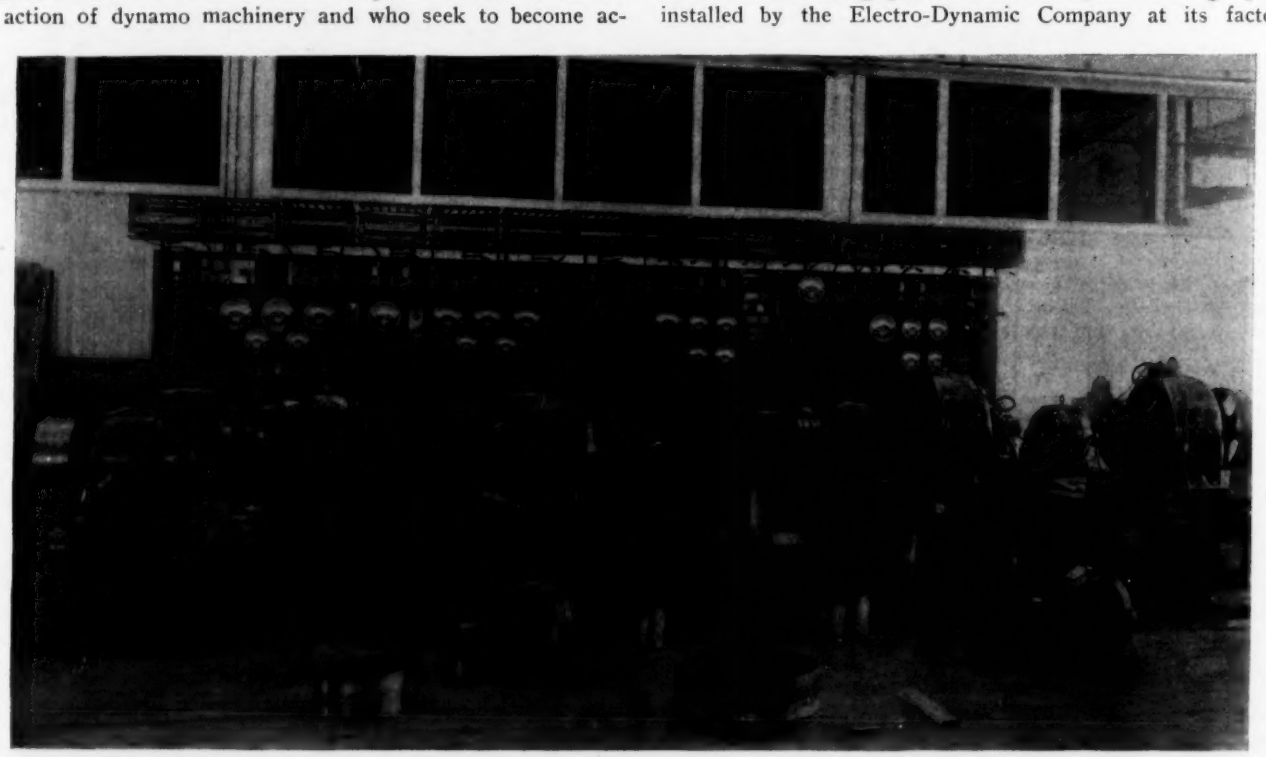
The Steam Engine and Other Steam Motors. Vol. 1: The Thermodynamics and the Mechanics of the Engine. By Robert C. H. Heck. New York: D. Van Nostrand Company. 391 pages, 190 ilustrations. Price, $3.50.

Elemente der Vektor-Analysis. Second Edition. By A. H. Bucherer. Leipzig: B. G. Teubner. 103 pages, illustrated. Price, 2.40 marks.

Die Elektrischen Bogenlampen. By J. Zeidler. Braunschweig: Friedrich Vieweg und Sohn. 140 pages, 130 illustrations. Price, 5.50 marks.

Testing Equipment of the Electro-Dynamic Company.

Before making factory tests on commercial machines the usual procedure is to fasten the machine to the floor and belt it to another machine which it is to drive or be driven by, according to whether the tested machine is a motor or generator. The time spent in thus adjusting the machine and the belt is oftentimes almost as great as that required for the actual test, factory test runs as a rule being quite short. The special testing equipment installed by the Electro-Dynamic Company at its factory in Bayonne, N. J., is unique in that the time required to adjust the machine is reduced to a minimum, and the test board connections made extremely simple.



Testing Equipment.

The machines built by the company are the now well-known "Inter-pole" variable-speed motors, the speed variation being obtained entirely by a variable resistance inserted in the main field circuit, which is shunt-wound, the small inter-poles, which counteract field distortion, being series wound. As shown in the illustration herewith, four testing units are provided, each

comprising a table and a switchboard fitted with all necessary instruments and accessories. This equipment is capable of taking care of seven sizes, the smallest being rated at 1 hp at a four-to-one speed variation and at about 2½ hp at constant speed; and the largest rated at 15 hp at a four-to-one speed variation and at 40 hp when running at constant speed. Generators are provided with the same frame sizes as motors. Although the company builds generators and motors for 500 volts, the majority of the machines are wound for operation on 110 or 220-volt circuits, and current at these potentials is supplied to the board.

Each of the tables is 7 ft. long, the two on the right being 30 in. wide and about 21 in. high, while the two on the left, intended for machine sizes four to seven inclusive, are about a foot wider and three inches lower. The dimensions of the tables were chosen with a view to having the machines overhang only a trifle if at all, the height being such that any adjustment such as setting the brushes, taking speed measurements, applying terminals, etc., can be easily made. The tests usually consist of heat runs and efficiency tests at minimum speed, and with variable-speed motors a short, full-load test at maximum speed for the purpose of determining the resistance needed in the controller for speed regulation and also to observe conditions of sparking.

The company finding the greatest demand for its motor rated at 5 hp on a four-to-one speed variation for machine tool operation, all four tables are capable of testing this size of machine. The table framework is made of three-by-four timber well braced and covered with 3-in. planking, the bolts used in the construction having their heads countersunk. A casting is fitted at each end of the table to receive a bed movable along the length of the table, the distance apart of the beds beng regulated by screws. Each bed is provided with 16 drilled and tapped holes, each set of four holes being spaced to receive the holding-down bolts of one of the standard size frames. The arrangement is such that the central planes of the standard pulleys of all sizes coincide, so that when two machines of the proper size are placed on the table and the belt arranged, the latter will run steadily.

Each switchboard section to accompany a table is provided with a motor and a generator panel since nearly all the tests involve the use of a motor and generator. A 110-220-volt, three-wire circuit supplies the board, and whenever current at a higher potential is required, this is supplied by a motor-generator set. Above the top of the board may be seen fifteen load rheostats. These have terminal posts on the board as shown, by means of which they may be connected in series, multiple or series-multiple, according to the voltage and current of the generator. The motor panels are provided with field rheostats of high resistance and others of large current-carrying capacity. An ammeter, switch and fuse are provided in the field circuit, and a controller with reversing switch, fuses and two ammeters in series are provided in the armature circuit. One ammeter has a scale reading up to 15 amp. and is used for measuring the load current of small motors and also the current taken by a motor running free; beyond its range it may be made inactive by means of a shunting switch. The second ammeter, which is always in circuit, has a range large enough to measure the current on any motor operating from the board.

The field circuit arrangement of the generator panels is almost the same as that of the motor panels with the exception of the rheostats, which are not so varied and which do not possess so great a resistance. Included in the armature circuit is an ammeter, circuit-breaker, fuses, a set of cast-iron grid rheostats for loading the generator and a double-throw switch for leading the generator load to the rheostats or back on the power line. The voltmeter on each pair of boards is provided with leads extending to the table so that voltage readings, etc., may be taken from any part of the table. A shelf is arranged along the face of the switchboard for note books, pads, additional instruments, etc. By means of the overhead crane with which the shop is equipped, a machine may be picked up in any part of the shop and deposited on the table where the test is to be made, after which the same means is used to convey it to the shipping department. Although in operation only a little over a year the company is now building machines with 397 ratings, about 15 sizes of frames being used.

Curtis Steam Turbines in Mining Work.

The economy of the steam turbine at all loads renders it particularly adaptable for mining power purposes in conjunction with electricity as the intermediary, and now that transportation by electric mining locomotives and mine lighting by electricity have become so well established the steam turbo-generator is the logical source of the necessary power.

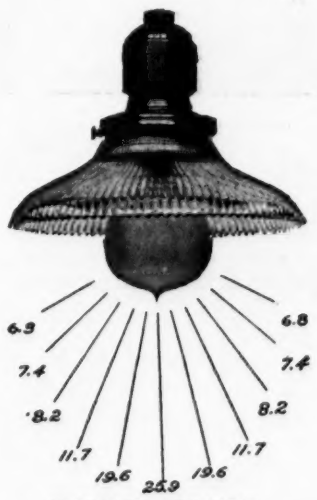
The Curtis steam turbo-generator, built by the General Electric Company, of Schenectady, N. Y., has met with much success in this class of work. Seven 500-kw, 2,300-volt, 60-cycle alternating-current generators driven by Curtis turbines have been purchased by the Delaware, Lackawanna & Western Railroad Company for operating mining locomotives and hoists in the coal mines at Scranton, Pa. Three of these machines were put in commercial service in November, 1903, and such has been their success that another has since been installed and an order has been placed for three additional machines which are now being installed at Nanticoke, Pa. Other Curtis turbines in process of construction for coal mining work are a 500-kw machine at Iron Mountain, N. Y., for the Delaware & Hudson Railroad Company; one 1,500-kw and one 75-kw machine for the Cowanshaunock Coal & Coke Company, at Echo, Pa., and two of 75 kw for the North Jellico Coal Company, Louisville, Ky.

One of the most recent adaptations of the turbine in this work is at Flat River, Mo. The Federal Lead Company will install three 500-kw, four-stage, 480-volt Curtis steam turbo-generators, which will operate at 60 cycles, three-phase, for lighting and power work in the company's mines. A duplicate exciter system will be furnished, consisting of a 25-kw turbo-generator set. In addition to the above, the General Electric Company will also furnish a complete switchboard equipment for a three-phase power feeder system, and for four single-phase lighting circuits.

In foreign countries the Consolidated Gold Fields Company, of South Africa, has one 1,000-kw and three 500-kw Curtis steam turbines in successful operation. In the same country also the Witwaters Rand Deep Mining Company operates a 500-kw turbine, using the power so generated in gold mining. In Japan a 1,000-kw machine is being installed in the Miike Coal Mine.

Prismatic Reflectors for Incandescent Lamps.

In connection with the interest which has been aroused in the application of effective lighting combinations consisting of sci-



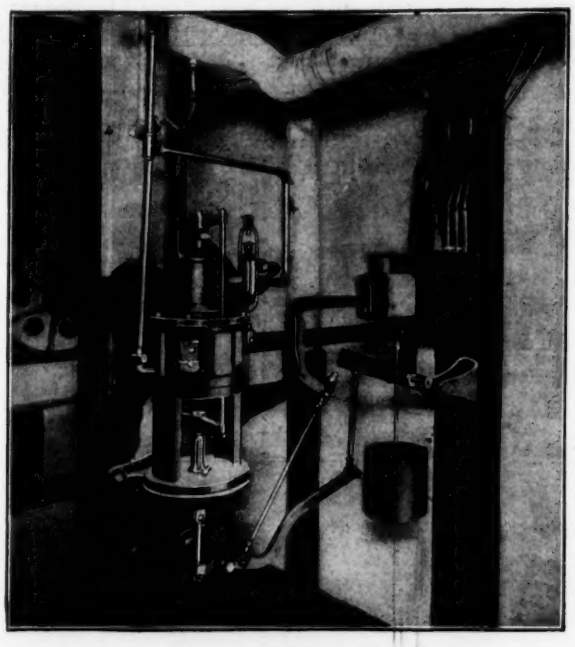
PRISMATIC REFLECTOR.

entific prismatic reflectors and high-efficiency lamps, it may be well to call attention to some very useful shades which have recently been developed for use with small units. These reflectors are made in six styles, of which three are used for distributing the light, and three for concentrating the light. Each of these reflectors is made to fit a standard 2.25-in. holder, and, as the illustration will show, is very graceful in design. They are

just being placed on the market by the Holophane Glass Company, 227 Fulton Street, New York.

Intermittently-Operated Elevator Pump Induction Motor.

It has been customary when installing induction motors for operating pumps supplying hydraulic elevators to run the motor continuously and provide an automatic by-pass around the pump so that the discharge of the pump will return to the suction whenever water is not needed to maintain pressure in the tank. In the Tudor apartment building in Chicago, which has a motor operated off the two-phase circuit of the Commonwealth Electric Company, a 15-hp induction motor was installed belted to an 8 by 10-in. triplex pump. This motor which was installed by the Adkins, Young & Allen Co., of Chicago, is provided with means for automatically starting and stopping the motor according to the pressure of air above the water in the compression tank supplying the elevators. The arrangement for starting and stopping is very simple and is illustrated in the accompanying engraving, for which we are indebted to the *Electric City*, published by the Chicago Edison Company. The motor is controlled by a General Electric oil switch. The oil switch is operated by the mechanism of a regular Mason belt shifter, the belt shifter being



PUMP INDUCTION MOTOR.

operated hydraulically by the tank pressure. This shifter is such as is used for shifting belts on elevator pumps driven from line shafting. The belt shifter operates between the pressure of 35 and 80 pounds per square inch, throwing the switch on at the former pressure and off at the latter pressure.

Electrical Features of a Textile Mill.

There is now under construction at South Lawrence, Mass., the largest and most finely equipped factory in the world for the manufacture of worsted yarn. This mill, that of the Wood Worsted Company, will embody many novel features and conveniences for the comfort of 5,000 employes. It will have a total floor space of 1,300,000 sq. ft. distributed in three buildings. Of these the main structure will be 1,437 ft. long, 123 ft. wide and six stories in height. Apart from this will be the power house, boiler house and office. This latter is so arranged that, in event of future extensions, it will form a portion of another mill, which is planned to be a duplicate of the one now in process of construction.

In the electrical equipment of this mill there are several engineering features and details in the general plan of operation, which invite special attention. The main building will be heated and ventilated by the blower system and the further comfort of the operators is assured by the proposed installation of escalators which are of such a capacity that they will carry the 4,000 employes in this structure from basement to the top in five minutes. The boiler house for supplying steam to the plant will eventually contain forty horizontal return tubular boilers, 78 in. in diameter and 20 ft. long. Mechanical draft with duplex fans and economizers will provide for the most economical fuel consumption.

In the power house are to be located two main generating units. These consist of a double non-condensing engine rated at 1,800 hp, running at 133 r.p.m., direct-connected to a 1,500-kw General Electric generator, and a second unit, comprising a compound condensing engine with two vertical and two horizontal cylinders of 5,000 hp capacity, running at 120 r.p.m., direct-connected to a 4,000-kw General Electric generator. The exhaust steam from the non-condensing engine will be used for heating, wool washing, dyeing and finishing, and the condensed steam from the compound engine will also be used in these operations. In addition to the main generating units, there will be a 100-kw, 240-r.p.m. generator for light loads and emergency work. Excitation current for the generating units will be furnished by a 65-kw, 125-volt, motor-driven generator, with a small direct-connected steam unit of like capacity acting as a reserve.

These main generating units, above mentioned, will supply current at 40 cycles and 600 volts to a most complete and modern switchboard, from which distributions will be made to the various buildings. The switchboard will consist of 33 panels, with lighting and power feeder circuits grouped on opposite ends of the board. These circuits are planned so that different parts of the mill can be operated individually.

About 5,000 hp of induction motors will be employed for this group driving of machinery. The motors are of the latest General Electric type wound for 550 volts and range in size from 8 to 175 hp. All motors are planned for ceiling suspension. With each motor of 125 hp or above a non-automatic switch will be installed, as each of these motors is on a separate feeder circuit protected at the main switchboard by an automatic switch. The smaller motors are safeguarded by automatic oil switches installed on a trunk line.

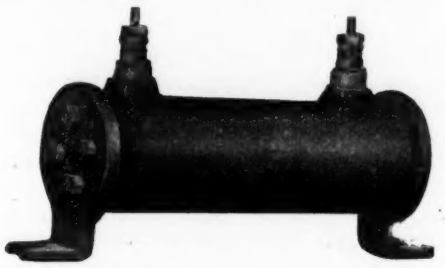
The general lighting will be done by direct-current arc lamps, the steps in current transformation from alternating to direct being taken by constant-current transformers and mercury arc rectifiers. This system possesses marked advantages as to first cost and economy of operation, over the ordinary methods of transformation. In this case constant current from the main generating units is obtained by four 50-light General Electric, constant-current transformers. The constant alternating current so obtained is rectified by means of General Electric mercury arc rectifiers and operates 200 direct-current arc lamps. Aside from the arc lighting, six 25-kw and two 10-kw General Electric transformers will furnish current for the incandescent lamp illuminations.

Throughout this mill the engineering features have been carefully studied to incorporate the latest devices and best methods possible in the production of its output. The wide experience of the president of the Wood Worsted Company, Mr. Wm. M. Wood, and its treasurer, Mr. B. F. Smith, Jr. (associated with the American Woolen Company), as well as the engineering ability of its designers, mostly men associated with that company, are reflected in the model construction and carefully selected equipment. The building plans were drawn by Dean & Main.

25,000-Ohm Resistance Coil.

The accompanying cut shows a resistance unit manufactured by the Ward-Leonard Electric Company, Bronxville, New York, which is of especial interest in that an extremely high resistance with a large ampere capacity is obtained in a unit whose over-all

dimensions are very small. The resistance of the unit is 25,000 ohms, with a capacity of 80 watts continuous service and with a capacity for great overloads for short periods of time. This unit is 6 in. long by 2¾ in. in diameter. The unit consists of three Ward Leonard enameled resistance units enclosed in a casting, the space between the enameled tubes being filled in with sand. The sand fills the entire space and holds the tubes so that they are not subjected to any mechanical strain. The sand has a very high specific capacity for absorbing heat energy, which permits the enameled units to be greatly overloaded for short periods of



25,000-OHM RESISTANCE UNIT.

time. Each enameled unit has a resistance of 8,300 ohms (approximate), is 4 in. long and 7/16 in. in diameter. The resistance wire has a temperature coefficient not greater than that of German silver. The unit is entirely enclosed, rust-proof and does not present a fire hazard. The Ward Leonard Electric Company claims that this is the smallest unit in the world for this high resistance.

A Simple Composing Machine for Advertising Matter.

The typesetting and composing machine shown in the accompanying illustrations aims to cover a field which no machine has heretofore invaded; that is, the composition of advertising matter which is ordinarily of so irregular a character that it cannot be set on the composing machines now in use. Advertisements usually require several changes of fonts in order to give due emphasis to certain parts and make them stand out prominently. For this reason an advertising composing machine should be provided with a multiple font magazine so arranged that any font can be brought into action without a moment's delay. Furthermore, the matter must be set in individual type instead of line slugs, because, owing to its diversified character it is more liable to contain errors than is straight matter, and errors cannot be easily corrected when the lines are cast in solid slugs.

These requirements are met in the new composing machine, which carries a four-font magazine, comprising a total of 400 matrices. A keyboard of a hundred keys controls the matrices and any of the fonts may be brought into operative position by shifting a lever. Individual character type is cast, the casting taking place immediately after the key is touched and without waiting for an entire line or column to be set. In this machine no spaces are cast until all the characters of a line are cast, but the words are assembled separately in chambers of an auxiliary magazine, and then the spaces are cast and moved successively into the galley with the words. The necessary thickness of the spaces is determined by a simple counting device on the machine.

By adopting this method of justification the mechanism is reduced to the extreme of simplicity. The machine which is here shown contains but 200 pieces, as against 1,800 in one of the prominent composing machines now in use. This great simplification of parts is due entirely to the new system of justification. Another feature which has done much to simplify the machine is the free use of electricity to control the various actions. In this way all the usual keyboard complications are entirely avoided.

The matrix magazine is very unique. It consists of several bars rectangular in section and bearing the matrices in single rows on their several faces. The purpose of having several bars is to provide for the difference in body thickness required by various characters. The same characters are duplicated on each of the four faces of the bar, but in different fonts, so that when it is desired to change from one to another of these fonts the bar is turned until the required face is brought to the operative position. The entire magazine of matrix bars turns simultaneously and the operations can proceed with the new font until

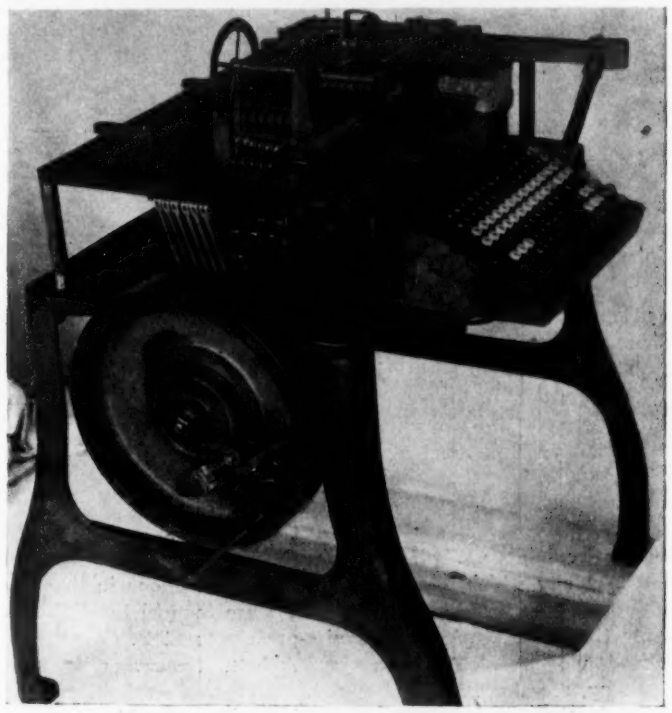


FIG. 1.—MAGNETICALLY-OPERATED COMPOSING MACHINE.

another change is desired, which may be similarly effected. The entire magazine can be removed and replaced with a new one in half a minute, and if the new matrices call for a type body of different thickness the entire operation, including change of the mold, can be done in a minute and a half.

The operation of the machine may be understood by referring to the drawings. Whenever a key, *a*, is touched, it completes the circuits of three electromagnets, *B*, *C* and *D*, as shown in the diagram, Fig. 2. There are six magnets, *B*, one for each matrix bar, and a hundred magnets, *C*, one for each matrix. When a magnet, *B*, is operated it withdraws a dent, *b*, from the slide bar, *E*, permitting the latter to move forward under tension of a spring acting on a lever, *e*. The slide bar carries the matrix

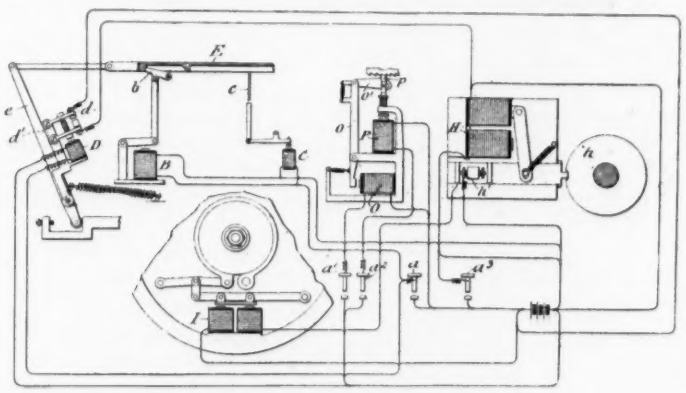


FIG. 2.—DIAGRAM OF CIRCUITS.

bar over the mold. The magnet, *C*, operates to stop the matrix bar when the proper matrix reaches the mold, and this it does by raising a pin, *c*, in the path of a heel formed on the slide bar. The whole operation of casting the type and returning the matrix to its initial position is controlled magnetically, as is also the casting of the spaces.

The action of the machine is exceedingly rapid, even more so than was at first anticipated. As originally designed the circuit

of the magnetic clutch, *I*, was closed immediately on touching a key of the keyboard, but the cam shaft responded so quickly that a matrix bar was often clamped to the mold before the desired matrix was reached. This necessitated the use of the ingenious circuit closer, *D*, which would operate only when the proper matrix arrived at its destination.

A patent on this simple type composing machine has recently been granted to Messrs. John R. and Gustave A. Pearson, of Brooklyn, New York.

The Chicago Electrical Show.

The past two weeks have been busy ones in electrical matters in Chicago. The Electrical Trades Exposition held at the Coliseum January 15 to 27 served as a drawing card for meetings and conventions of electrical men from all over the middle west. These conventions are reported elsewhere. The Electrical Show itself has proved to be a great success in attendance and in the support given by manufacturers. The floor of the Coliseum was fully occupied. The evening attendance was all and sometimes more than could comfortably be accommodated.

The management of the Electrical Trades Exposition Company, of Chicago, which carried out the undertaking certainly deserves great credit for its marked success in a time when electrical exhibits are being so frequently asked of manufacturers and in a city which has its full share of attractions in the way of shows of various kinds. The officers are Samuel Insull, president; Charles E. Gregory, first vice-president; E. B. Overshiner, second vice-president; John Jay Abbott, treasurer; Stewart Spalding, secretary, and Thomas R. Mercein, general manager.

The active management was mainly taken by Mr. Mercein and by Mr. Homer E. Niesz, of the Chicago Edison Company, who was a director in the exposition, and had charge of publicity matters. The show has been successful beyond any of the hopes of exhibitors or promoters. Exhibitors who went in expecting benefit only in the way of general publicity without direct returns have found the direct returns excellent.

The General Electric Company made an exhibit the most prominent and best crowd-drawing feature of which was a display of new cooking and heating appliances. These were shown in operation by demonstrators who were constantly in attendance. Besides the G. E. flat-iron and coffee percolator there were many other recently developed cooking and heating devices, including broilers, toasters, waffle irons, glue pots, luminous radiators, cigar lighters and heating pads. There was also exhibited a small geared motor for operating a breast drill and similar, somewhat larger, motors for operating sewing machines and other household machinery. Among the heavier apparatus exhibited was a motor generator set for automobile charging from alternating-current circuits, a hoist and a mercury vapor rectifier. The booth was surrounded with rows of "G. E. M." high-efficiency incandescent lighting units with prismatic glass reflectors. The recent lamps of this type do not have the frosting carried as far up on the lamp bulb as the first ones because of the reduction of light due to frosting. In another part of the building, was a 25-kw horizontal shaft, direct-current Curtis turbo-generator running 3,600 r.p.m. such as is used for exciter units and train lighting. There are some 21 of these in service on Pennsylvania limited trains, 5 on the Burlington Denver trains, and on other roads.

The Chicago Edison Company and its allied companies, the Commonwealth Electric Company and the North Shore Electric Company, occupied the best and most prominent space in the center of the Coliseum. These companies fitted up a kitchen where all kinds of cooking was done electrically. Joining the kitchen was a dining room, showing how artistically an electrically-lighted dining room can be arranged. Over the dining room table was a large art glass shade hanging by four bronze chains from the ceiling. The art glass shade had a brown glass septum for diffusing and softening the light from the incandescent lamps contained in the shade. Around the canopy of this fixture was a cluster of round frosted lamps. The whole effect was very pleasing. Adjoining the dining room was a space occupied by an electrically driven refrigerating machine from the Brunswick Refrigerating Company, of New Brunswick, N. J. In another part of the booth was a large Miehle printing press operated with electric motor and some smaller motor applications. A handsome special edition of the *Electric City*, published by these companies was issued for the Electrical Show, and a daily edition of this publication was also printed during the show on the motor-driven printing press in the booth.

The Chicago Pneumatic Tool Company exhibited its line of electric breast drills which have been placed on the market to do the work heretofore performed only by pneumatics. As electric current for operating is much more generally obtainable than compressed air, it goes without saying that there is an immense field for these drills in the marketing of which the Chicago Pneumatic Tool Company will have the hearty co-operation of central station companies wishing to extend the market for power. This exhibit also included samples of the "little giant storage battery."

The Federal Electric Company, of Chicago, was well represented by signs in its own exhibit space and by numerous other electric signs over the Chicago Edison Company's exhibits and many others.

The Haller Machine Company had a very large attractive sign operated by a flasher at the booth of the American Electric Supply Company and a very large exhibit of different styles of electric signs in that booth in addition.

The Phoenix Glass Company had a small but handsome display of some of the latest designs of electric shades for use with incandescent lights and arc-light inner globes.

The Coburn Flexible Conduit Company, and the National Metal Molding Company, of which I. A. Bennet is the western manager, exhibited a small house or booth of Economy iron conduit and "Fexduct" flexible conduit.

The University of Wisconsin engineering department made an exhibit, the most interesting features of which were an electric furnace of the type used in the notable investigations carried on with electric furnace work at that university by Prof. Burgess and others, and samples of products obtained from the electric furnace. Some interesting photographs were also shown of buildings and work rooms at the university.

Armour Institute of Technology made an exhibit consisting largely of testing apparatus. One part of the exhibit was devoted especially to its work in telephony under Prof. Kelsey.

C. H. Thorardson, designer and builder of special experimental and high potential apparatus, gave frequent exhibitions of high-potential discharges from a transformer which he used in similar demonstrations at the Louisiana Purchase Exposition in St. Louis. It is hardly necessary to say that these high potential discharges raised more commotion and attracted more attention when in operation than anything else on the floor of the Coliseum. Mr. Thorardson also showed a very neat and substantial set of appliances for demonstrating the fundamental principles of electricity and magnetism which he makes for schools and colleges.

The Electric Appliance Company exhibited Packard lamps, Sangamo wattmeters and various other goods which it handles.

The Sangamo Meter Company made a very fine exhibit of its new non-infringing wattmeter for alternating or direct-current circuits. This wattmeter is the one described in the Electrical World recently.

The H. A. Petersen Manufacturing Company constructed its booth of "Harvey-duct," the iron pipe conduit which it manufactures at its new factory at Harvey, Ill., along with marine-duct and interior-duct.

The Overbaugh & Ayers Manufacturing Company had an extensive exhibit of the "Oamco" universal swing brackets and portables. This company makes a specialty of adjustable brackets, very useful for shop, drafting room and office lighting.

The Sarco Company had as the most novel feature of its exhibit a couple of flame arc lamps of German manufacture, using impregnated carbons with a wire core. The light given is golden yellow. These lamps burn two in series on 115 volts and were said to consume four amperes. They operate on direct or alternating-circuits. These lamps are of the type in which the car-

bons both point downward at an angle, the arc being at the lower tips. The life of the carbons is stated to be about 14 hours, consumption being about one inch per hour.

The Wagner Electric Manufacturing Company, of St. Louis, exhibited both its regular constant speed, self-starting, single-phase induction motor and its hoist motor which starts with characteristics similar to a series motor.

The B. F. Sturtevant Company exhibited a direct connected marine engine and generator, and some electrically-driven fan blowers.

The Simplex Electric Heating Company had one of the largest and best visited exhibits. It was devoted entirely to electric heating appliances, of which it makes such a large variety. It included all sizes of irons from the smallest to the largest in commercial use, chafing dishes, in at least six different designs, curling irons, heaters, heating pads, nursery milk warmers, water cups for boiling water, soldering irons, glue pots, hair dryers, ovens, griddles and electric ranges. An electric kitchen was kept in operation.

The Peru Electric Manufacturing Company exhibited its porcelain specialties for electric purposes, of which it makes an immense variety.

The Lang Electric Company showed samples of its switchboard work.

The General Storage Battery Company had a large exhibit showing its "Bijur" batteries for all purposes from spark coil operation to central station and isolated plant work.

Dossert & Company exhibited their famous appliances for terminals and splices in electrical work.

The H. B. Camp Company had a booth devoted to Camp tile duct.

The Automatic Electric Company exhibited its automatic telephones and a small automatic exchange.

The American Circular Loom, of which Thomas G. Grier is the western representative, made an exhibit at the Grier Company's booth. Mr. Grier also showed other specialties for which he is agent.

The American Steel and Wire Company exhibited its steel and iron wire products, and a variety of bonds and rail bonding tools.

The Guarantee Electric Company had in process of reconstruction an armature showing the repair methods used by this company.

The Stanley-G. I. Electrical Manufacturing Company had its exhibit moving promptly at 8.30 on the opening night. It had a prominent place well occupied by both stationary and moving machinery. A Challenge Gordon press was belted to a new type direct-current printing press motor in operation. An automatic motor-driven stereopticon threw on a small screen pictures of the factories and apparatus, interspersed with works of art. Polyphase and single-phase induction motors were shown, the latter of the resistance and reactance type. The arc apparatus was especially complete, including regulators, an arc panel switchboard and a test rack on which were placed the latest types of lamps, including the L4 midget lamp and the K31, which has the carbon holder mounted on a crosshead and is wound with indestructible magnets of enameled wire. A table contained samples of the Wright "maximum demand" meter, hot-wire ammeters and voltmeters and watch case instruments, besides many others. A new slide oil switch was shown and fittings for interior work.

Crane Company.—The exhibit of Crane Company afforded engineers and others interested in power plant equipment an opportunity of seeing the latest design and improvements in valves and steam specialties. Two of the valves shown were equipped with electrical devices by means of which the operation may be controlled from any desired point. One of these valves was an 8-in. high-pressure motor-driven "Ferrosteel" gate valve. In this arrangement a motor is attached directly to the valve in such a way that by the operation of the motor the valve may be opened or closed as desiired. When the switch, located at any distance from the valve, is thrown to open or close the valve, the motor continues in operation until the valve has been tightly seated or opened full. At the completion of this movement the motor automatically stops. The other one of the electrically-operated valves was a 24-in. hydraulically-operated gate valve provided with an electrical device by means of which the admission of water into the operating cylinder is controlled. Both of these valves were connected up so that their practical operation could be seen. Among the other valves and steam specialties exhibited was an 8-in. triple-duty, high-pressure globe valve, an 8-in. automatic stop and check valve, a 30-in. low-pressure gate valve, an 8-in. high-pressure separator, a 24-in. vacuum oil separator, an 8-in. high-pressure vertical separator, a Cranetilt return and a Cranetilt non-return steam trap.

The Western Electric Company exhibited a marine set consisting of a 50-kw generator direct-connected to a vertical engine. The set was designed especially for steamship lighting, but is well adapted to any restricted floor space. The exhibit included a number of power motors of various sizes and motors for crane and hoisting service, of the box type, built very compact and designed to stand heavy service. Sewing machine motors of a new type built for alternating-current and for direct-current work were shown operating machines. The speed regulating gear of these motors is so constructed that the speed may be varied through a very wide range by simply pressing down the tread of the machine. When pressure is removed from the tread, the motor is cut out of circuit. The whole exhibit was flooded with light from a string of 25 series alternating standard street arc lamps. These lamps were connected to a series regulator. In the background of the exhibit were three large paintings showing the New York, the Chicago and the Hawthorne factories of the company.

The Monarch Electric & Wire Company had space near the fountain in the center of the building. Samples of weatherproof wire manufactured by the company were shown in sizes varying from No. 20 wire to 500,000 circular mil cable. Galvanized strand wire of several sizes was also exhibited.

The Manhattan Electrical Supply Company exhibited a full line of telephones and parts used in the construction of telephones. In addition to these electric bells of various sizes were shown. Telegraph instruments of various kinds were placed in a showcase near the aisle.

The Edwards Electric Headlight Company had several of its headlights in operation. The lights are adapted for use in locomotives, wrecking cars, steam shovels and interurban cars. The turbine and dynamo operating them are built on the same base as the headlight.

The American Electric Sign Company had on exhibition a number of signs of its manufacture.

The Acorn Shade & Reflector Company, of Chicago, had a very attractive exhibit of stand and ceiling lamps fitted with arc glass shades.

H. T. Paiste had space in the southern portion of the building where were exhibited Fielding receptacles, fuseless rosettes and other specialties for window lighting.

The Central Electric Company had at one corner of its booth a pillar consisting of reels of "Okonite" wire. Attached to this was a "biscuit" consisting of a half sphere about 2 ft. in diameter of crude rubber used in insulation of Okonite wire. A rather interesting feature of the exhibit was a piece of submarine cable which had been caught in the screw of a tugboat and twisted out of shape. This cable illustrated the amount of torsion the cable may be submitted to without destroying the insulation. In addition to these features the exhibit included a full line of D. & W. new code fuses and all styles of fuse boxes. In one corner of the booth was a case containing every type of lamp manufactured by the Columbia Incandescent Lamp Company.

The American DeForest Wireless Telegraph Company had an exhibit and a receiving station at the Coliseum which received its full share of popular attention.

The Chicago Lamp & Reflector Company made a display of its shades and reflectors for electric purposes.

The Electric Storage Battery Company, of Philadelphia, had a very attractive exhibit, showing the various types of storage batteries, both the "Chloride Accumulator" and the "Exide Accumulator" being exhibited. The largest cell exhibited, a type R-71 element in a type R-83 lead-lined tank, is a duplicate of one of the 2,544 cells now being installed by the New York Central

& Hudson River R. R., on the lines between New York and Poughkeepsie. Each cell has a capacity to discharge 4,200 amperes for a period of one hour. Other cells shown were a G-9 in lead-lined tank, an F-11 in glass tank, and E-11 in glass jar. A switchboard panel, of blue Vermont marble, had mounted upon it the standard instruments used in the operation of an electric railway line battery. Railroad car-lighting cells of several types were shown. The Illinois Central R. R. is equipping its system with "Chloride" and "Exide" batteries, for block signal service, and samples of these were exhibited. The "Exide" vehicle and sparking batteries occupied a prominent place. The exhibit was in charge of the company's Chicago office staff. consisting of Messrs. G. H. Atkin, J. M. S. Waring, J. A. White, Irving Seaman, and H. B. Marshall.

The McFell Electric Company had installed as a feature of its exhibit an open circuit fire alarm system having a constant test on the line. But two wires are used for wiring the system, and any number of boxes may be placed on these circuits. The number of the box pulled is registered at the central station.

The Fort Wayne Electric Works had a prominent space and large exhibit near the center of the building. Arc lamps were hung from side posts, and a corner post was utilized to display electric fans of the company's manufacture. A feature was made of the Fort Wayne prepayment induction watt-hour meters. These, as well as multiphase meters and other types of Fort Wayne meters, were mounted on the rear wall. Some were connected up and in operation, the covers being removed to show the parts. Show cases near the aisles contained all the parts necessary in the construction of meters. In addition to machinery manufactured by the company there was also shown in the booth the Shelton electric vibrator.

The Dayton Electrical Manufacturing Company, the Bishop Gutta Percha Company, the American Electric Heater Company, the Electric Gas Lighting Company and the Schwarze Electric Company were represented by D. G. Welling, who has recently opened up a Chicago office for these companies. The displays were made in the booth of the McFell Electric Company.

Sam J. Gorman & Company exhibited a full line of vibrating apparatus. A vibrating bed attracted much attention. The patient lies on water cushions, some of which are heated by electricity. An electric motor beneath the bed gives the vibratory movement.

Charles E. Gregory, president of the Guarantee Electric Company, had on exhibition the first dynamo installed in Chicago. This was a bi-polar machine brought to Chicago and exhibited in the *Inter-Ocean* office in September, 1875. Some of the lamps used with the machine were suspended nearby. These consisted of large globes filled with nitrogen and hermetically sealed. The carbon pencils fed upwards automatically. The lamps took 30 amperes at 10 volts, and had a life of about 700 hours.

The Bryan-Marsh Company exhibited all styles and sizes of incandescent lamps of its manufacture. These varied in size from a small "peewee" lamp to some of 150 cp. The company was represented by F. B. Nicholl, city salesman for Chicago, and E. H. Haughton, general manager of the company.

The Nungesser Electric Battery Company showed in pyramidal form several sizes of its 1900 type dry battery. Other styles of dry batteries manufactured by the company were also shown.

The National Carbon Company exhibited on a structure of carbon in the center of the booth a Columbia dry battery of 1,000 amperes capacity. Other makes of dry cells in which carbons are used of the National manufacture were also shown. The central structure supporting the batteries was surrounded by various carbon products, while parts of telephones, carbon brushes and electric light carbons completed the display.

The McRoy Clay Works exhibited single duct conduit and other styles in nests of two, four and six ducts. Attractive photographs, showing installations of conduits in various cities, were also shown.

The Miller Anchor Company exhibited anchors of various sizes and styles.

Felix Hamberger exhibited several Siemens flame arc lamps. The peculiar colors of the rays given off by these lamps attracted much attention.

The Safety-Armorite Conduit Company adopted a unique method of showing the smooth interior of its conduits. Various sizes of "loricated" and "galviduct" conduit were mounted on a frame, a small incandescent lamp being placed in that end of the conduit farthest from the aisle. The smooth interior could be readily observed. The exhibit was in charge of A. H. Friend.

The M. Krantz Manufacturing Company displayed panel boards, and other electrical apparatus. Photographs of large buildings in which the company's products have been installed were hung on the walls of the booth.

The Metropolitan Electrical Supply Company had on exhibition a new flasher recently gotten out by the Phelps Company. This is the "skedoodle J," and is operated by a thermostat. It will handle current up to 25 amperes. This flasher was shown in operation connected in the circuit of lamps of a sign above the booth. Other features of the exhibit were Barriett motors, "hylo" lamps and Dixon graphite brushes.

W. H. Schott, central station and heating engineer, showed a vacuum heating system. Steam was obtained from boilers in the basement of the building at about 100 pounds pressure. This was reduced to 6 pounds on lines corresponding to street mains. Radiators connected to the piping system were subjected to vacuums of 20 in., 19 in., and 0 in. The vacuums were maintained by thermostatic check air valves. Pressure gauges were placed in the pipe lines at various points to show the differences in pressure.

The Niagara Tachometer and Instrument Company exhibited several styles of tachometers in a very interesting manner. The instruments were all mounted on a stand and were belted to an electric motor below. These tachometers depend upon centrifugal force alone for their action, no springs or parts which may need occasional adjustment being employed.

The Electro-Dynamic Company had an exhibit that attracted considerable attention. An "interpolar" motor was belted to a duplicate, the latter being driven as a dynamo. A large station ammeter showed the load on the motor, and a voltmeter calibrated for speed indicated the revolutions per minute. The speed of the motor was varied through a range of 400 per cent. It was reversed at full speed and at 100 per cent overload, as indicated by the ammeter, without sparking at the brushes. Another feature of the exhibit was a Moloney transformer connected with instruments in the circuit for making efficiency tests. The exhibit was in charge of the Chicago manager, F. L. Merrill, and F. G. Bell, engineer for the company. Francis Raymond represented the Moloney Electric Company.

The Universal Electric Storage Battery had on exhibition a cell of 800 ampere-hours capacity that had been in service on the Chicago & Alton Railroad for the past eight months. There were no evidences of deterioration about the plates. Other styles of batteries shown included those for electric vehicles and for train lighting equipments. On a large board were shown parts of the battery in various stages of manufacture.

The American Conduit Company, in addition to different sizes and lengths of bituminized fibre conduit, exhibited a "line entrance" for carrying high tension wires into power houses and buildings. This "line entrance" is made of bituminized fibre conduit. Sections of fibre conduit laid in cement were also shown.

In the booth of the Benjamin Electric Mfg. Company were hung several types of its new "arc-burst" clusters. These attracted much attention on account of their neat appearance. The company also exhibited a new style of lamp guard which does not require the lamp to be removed when the guard is placed in position; and in addition wireless clusters both of the multiple and series type were shown in different stages of construction.

Porter & Berg had as one of the features of their exhibit a 75,000-volt insulator of the type used by the Edison Electric Company of Los Angeles, Cal. Other insulators that have been installed on lines of 60,000, 66,000 and 45,000 volts were also shown. A feature of the exhibit were the Imperial arc headlights for street railway service. In addition the exhibit included Kalamazoo trolley wheels of various sizes and styles, samples of Spear carbon brushes, Wilson trolley catchers and retrievers and International fare registers. At the entrance of the booth was an Empire safety tread. This tread, which consists of carborondum

embedded in a steel plate, has been used extensively on steps to elevated railway structures. The Central Electric Manufacturing Company exhibited a full line of Blackhawk dry batteries.

The India Rubber & Gutta Percha Insulating Company was installed in a neat booth where it exhibited cross-sections of lead-covered and other cables, as well as reels of insulated wire of various sizes.

University of Illinois.—In this exhibit the most interesting piece of apparatus shown was an oscillograph for recording the wave form of alternating currents. The walls of the booth were well covered by numerous views of the university buildings and laboratories. Among the photographs was that of the electric test car recently obtained for making street railway tests of various kinds.

The Vesta Accumulator Company exhibited an electric horn which has just been put on the market. It is for use on automobiles or street cars and is put in operation by pressing a button. It is operated by a Vesta ignition battery, a full line of which was shown.

The Lincoln Electric Company showed two of its variable-speed motors. The variations of speed in these motors are obtained by throwing the armature lengthwise of the shaft into a weaker field.

The Chicago Battery Company exhibited "Duro" searchlights of varying sizes. These are made from 8 to 50 cp and are for use especially on yachts. Portable Duro storage batteries varying in capacity from 25 to 250 amp. were also exhibited.

The American Electric Fuse Company was represented by P. G. Jones and G. W. Rodormer. The Allen-Bradley crane controller was a feature of the exhibit.

Purdue University exhibited a number of current measuring devices and other apparatus, all made by students. One of the most interesting features of the exhibit was an autographic recording apparatus for use in testing electric railway cars. The apparatus was used on the tests of the Electric Railway Test Commission. There was also exhibited lecture apparatus for demonstrating the properties of alternating-current circuits, for measuring the fall of magnetic potential, and for measuring core losses. Some charts showing the remarkable growth of the institution in the last few years and the number of graduates compared with other technical schools were of interest.

The Crocker-Wheeler exhibit was installed on one of the main aisles. The largest piece of apparatus exhibited was a 75-kw, three-phase belt-driven alternator. In addition to this the exhibit included a 12-kw belted exciter generator, a 5-hp, 560 to 1,600-r.p.m. variable-speed motor and a standard 5-hp, 30-volt, slow-speed machine. On the walls of the booth were hung photographs of special machinery manufactured by the company. These photographs included those of the 4,000-kw water wheel driven units to be installed for service on the Chicago Drainage Canal. The exhibit was arranged by Julian Roe, Western manager of the company, and was very neat in appearance.

The J. L. Schureman Co. exhibited a very complete line of elevator controllers, prominent among which was one of the four full magnet type which the company is supplying to the Mabbs Elevator Co. for installation in the Board of Trade Building in Chicago. The elevators to be controlled by these will travel at a speed of 600 ft. per minute. The exhibit included new gauge type of pressure regulators for pump and air compressor service, together with various sizes of automatic starters. The magnet switches designed by the company for the control at a distance of circuits of any capacity will in a great many instances eliminate the necessity of running heavy mains to the point of operation. The switches are equipped with carbon breaks and blow-out magnets.

The Allis-Chalmers Company, of Milwaukee, had a 25-hp, direct-current Bullock type N motor belted to a 60-kw Bullock alternator and this in turn generated alternating current for a line of Bullock induction motors ranging in capacity from 2 hp to 30 hp. Engineers visiting the exhibit were attracted at once by the ring from a 1,500-kw steam turbine placed on a table in one corner of the booth. There was also shown a section of blading from one of the 5,500-kw turbines now being built at the West Allis shops of the Allis-Chalmers Company. A large assortment of small motor and generator parts, including punchings and insulated coils, were also displayed, and these attracted a large number of people who were not particularly interested in the larger types of electrical apparatus. In two show cases were arranged the electrical and power bulletins of Allis-Chalmers Company, all of them being printed on India tint paper, and embellished in the handsome style now distinctive of that company's publications. The booth was lighted by a red, white and blue electric sign, from which hung clusters of incandescent lamps. A desk, settee and chairs in mission style with posts, railings and floor covering to match, together with Oriental rugs, completed the furnishing of the booth.

Westinghouse Exhibit.—The exhibit of the Westinghouse Companies occupied spaces 3 and 4 of Section D, and in it were displayed some of the products of the Westinghouse Electric & Manufacturing Company, the Nernst Lamp Company and the Cooper Hewitt Electric Company. The Westinghouse Electric & Manufacturing Company had on exhibition its graphic recording voltmeter, as well as a full and complete line of Westinghouse current-measuring portable and precision instruments. The recording voltmeter exhibited conveyed a good idea of the line of switchboard instruments being manufactured by the Westinghouse Company for making continuous records. The record is made by means of a fountain pen, moving in a horizontal line across the paper. The line of watt-hour meters comprised type B single-phase, type C polyphase and prepayment single-phase, alternating-current meters, and also a direct-current meter. In circuit-breakers were shown its type F oil, its type F carbon-break and its railway type circuit-breaker. Its exhibit of transformers comprised a 5-kw, "O.D.", a 7½-kw, single-phase, type "C," and also a 5-kw, three-phase type "C" transformer. Alongside of the 5-kw, "O.D." transformer were shown the coils for both low and high-tension, and also two low-tension coils assembled together, but sawed apart in the center to show quality and method of insulation. An appliance on exhibition which was of general interest to the public and of particular interest to central station operators, was a Westinghouse 5-kw pipe-thawing transformer. The company had a number of its smaller sizes of motors, including direct-current, type R motors of ½ hp, ¾ hp and 1 hp, a type "S" direct-current motor of 4 hp and a "C.C.L." induction motor of 5 hp capacity. In close proximity to the motors was shown a Westinghouse oil-immersed auto-starter. A line of Westinghouse fan motors for the season of 1906, for use on both alternating and direct current were displayed, and a complete line of Westinghouse arc lamps for both currents were in operation. Mounted on large display boards was a complete line of overhead railway line material for both direct-current and single-phase, alternating-curren catenary line construction. The exhibit was lighted on one side by Cooper Hewitt mercury vapor lamps and on the other by Nernst lamps. The electric sign overhanging the exhibit was illuminated by Sawyer-Man incandescent sign lamps. The Nernst lamps shown were the two-glower, four-glower and six-glower sizes.

Frank B. Cook's exhibit included a complete line of telephone protective apparatus, from switchboard protectors to pole cable terminals. One large main distributing frame had mounted on it the five different types of protective apparatus that Mr. Cook has made, the earliest type being the No. 4 with tubular coil and the latest being the No. 8 self-soldering protector. Pole cable terminals of all sorts and descriptions were also shown. Mr. Cook also showed a decided novelty in the way of a land anchor which bores its own way into any depth of earth desired, by simply turning it to the right, and a single turn to the left throws out two blades into the earth, obtaining a hold on practically 18 in. of undisturbed earth by the use of an anchor with a 6-in. blade. Cook's self-welding wire joints for connecting copper wires attracted a great deal of attention. The Cook joint is a decided departure. The joint is so made that the mere act of twisting draws the sleeve into the recess between the wires, stretching it absolutely tight around both wires, and making a perfect self weld. In addition to these novelties Mr. Cook showed his well-known line of junction boxes, guy clamps, test connectors, subscribers' station protectors, fuse strips, U-bolt clips.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Complaints are still made by the retail trade of the effect of the mild weather on business. Collections and some re-order business from wholesalers is likewise affected, but on the other hand outdoor industry continues with unabated activity, particularly building operations. Spring trade prospects continue as favorable as heretofore. All reports indicate an earlier than usual opening of wholesale operations in dry goods, shoes and kindred lines. Most staple products are notably strong for a mid-winter season, especially cotton. Finished materials in iron and steel are in active request, and the mills are running to full capacity with sufficient orders booked to insure a full six months' work and in some lines nearly the entire year. Structural plants have taken on considerable new work and the warm weather has greatly stimulated demand for finished products. Copper has weakened on consumers' efforts to resell overpurchases of spot metal. The closing quotations were 18¼c. for Lake and electrolytic and 18c. for casting stock. It is stated that the visible supply of electrolytic copper is the smallest for years, and that all that is likely to come from the refining works for months ahead is contracted for at prices well toward 19c. The exports of copper in the form of wire bars, ingots, plates and cakes, so far this month, aggregate 9,650 tons. The business failures for the week ending January 18, according to *Bradstreet's*, aggregated 279 against 286 the week previous, and 304 the corresponding week last year.

WESTINGHOUSE-PARSONS TURBINES.—The Westinghouse Machine Company, of East Pittsburg, Pa., has received during the past two months many orders for Westinghouse-Parsons steam turbines. The largest orders were received from the Transit Development Co., Brooklyn, N. Y., for a 7,500-kw turbine; Edison Electric Co., Los Angeles, Cal., for a 7,500-kw turbine; the Laclede Power Co., St. Louis, Mo., for two 2,000-kw turbines; the Chautauqua Traction Co., Jamestown, N. Y., for a 1,500-kw turbine; the Mt. Whitney Power Co., Visalia, Cal., for a 1,000-kw turbine; the North Shore Electric Railway, San Francisco, Cal., for a 1,000-kw turbine, and the Winston-Salem Power Co., Winston-Salem, N. C., for a 750-kw turbine. Other orders are from the Beacon Mfg. Co., New Bedford, Mass; Water, Light & Gas Co., Hutchinson, Kan.; Pressed Steel Car Co., Pittsburg, Pa., and the Solvay Process Co., Syracuse, N. Y., for 500-kw turbines, and from the Baltimore & Ohio Railroad Co., Baltimore, Md., and E. R. Ladew, Glen Cove, L. I., for 300-kw turbines. The turbine to be installed by the Transit Development Co. will be of the multiple expansion parallel-flow type, direct connected to an alternating-current generator running at 750 r.p.m., and will operate with dry saturated steam at 175 pounds boiler pressure and 28-in. vacuum. The generator will be of the rotating field enclosed type, and will deliver three-phase current at 6,600 or 11,000 volts. The Los Angeles Edison Co.'s turbine unit will be of the same general type. It will operate at 750 r.p.m., with dry saturated steam at 160 pounds steam pressure and 27½-in. vacuum, and will deliver three-phase current at 16,500 volts. The turbines for the Laclede Power Co. will operate at 1,200 r.p.m., with dry saturated steam at 165 pounds boiler pressure and 28-in. vacuum, and will deliver three-phase current at 2,300 volts.

AUTOMATIC TELEPHONES.—The Automatic Electric Company, of Chicago, reports a most prosperous year's business during 1905, with every prospect of a large increase during 1906. It is interesting to note that this company during the past year has installed 20 new public exchanges, representing a total of 23,418 subscribers' lines, one of which, at Columbus, Ohio, serves 8,000 lines. In addition to these public exchanges, the company has installed 10 private exchanges, serving a total of 413 stations. It is stated that the greatest growth in automatic telephony during the coming year will probably be on the Pacific Coast, franchises having been granted to independent companies in several cities, in which the automatic system is specified. It is claimed that at least a million dollars worth of business is in sight in this territory alone. Among the developments of the Automatic Electric Company during the past year are those of the party-line system and a new trunk selector switch. This switch is exceedingly compact, and it will admit of the installation of a multiple-unit system, consisting of scattered branch exchanges of one hundred lines each which can be put in the corner of a building, in the manhole of a conduit under the street, or in any convenient place, leaving the main exchange in the central part of the town for trunking purposes, thus doing away with a large percentage of the outside lines, and making a proportionate saving in outside construction and maintenance cost.

WESTINGHOUSE STEAM ENGINES.—The Westinghouse Machine Company, of East Pittsburg, Pa., has recently sold 6,130 horse-power of its various types of steam engines, the largest order being from the Illinois Steel Co., Chicago, Ill., for one 38 and 76x54 vertical cross compound Corliss engine of 3,000-hp capacity. Of the other types of engines manufactured by this company were sold 1,720 hp of Standard, 1,150 hp of compound, and 260 hp of Junior. These orders were received from the International Steam Pump Co.; Colorado Fuel & Iron Co.; St. Louis & San Francisco Railway Co.; Sonneborn Realty Co.; Pullman Car Works; American Pipe Mfg. Co.; Parks Gold Mine; Burgess Electric Co.; Wm. E. Peck & Co.; Chicago, Milwaukee & St. Paul Ry., and Hotel Walton, Philadelphia, Pa.

HOWARD E. CROOK & CO.—The Howard E. Crook & Co., of 320 West Mulberry Street, Baltimore, Md., have moved into larger quarters at the above address. They are now doing considerable work in both steam and electrical construction. The most prominent work which they now have under way is the Jacob Tome Institute, Port Deposit, Md.; Springfield State Hospital, at Springfield, Md.; New Maryland Institute Building, New Eastern High School Building, and the Washington Apartment House at Baltimore, Md. They have recently completed the construction work at the new electric power plant and sub-station of the Maryland Telephone Company in Baltimore. They are now in the market for considerable material for the above work.

CURTIS TURBINE SALES.—The Delaware, Lackawanna & Western Railroad Company has purchased seven 500-kw Curtis steam turbines from the General Electric Company for mining work at Scranton and Nanticoke, Pa. Other Curtis turbines in process of construction for coal mining work are a 500-kw machine at Iron Mountain, N. Y., for the Delaware & Hudson Railroad Company; one 1,500 and one 75-kw turbine for the Cowanshannock Coal & Coke Company, at Echo, Pa., and two 75-kw turbo-generators for the North Jellico Coal Company, of Louisville, Ky.

ROBINS BELT ORDERS.—The Robins Conveying Belt Company has recently secured an order from the Solvay Process Company, Syracuse, N. Y., for 16-in. and 24-in. belt conveyors. These conveyors are intended for use in one of the stone-crushing plants of its purchasers. Among other orders the Robins Conveying Belt Company now has on hand is one from the Highland Coal Company, of Somerville, Mass., for a bucket elevator, and one from the Western Engineering & Construction Company, of San Francisco, for a 30-in. conveyor for handling gold tailings.

OFFICE BUILDING EQUIPMENT.—The dynamos for "The Nicholas," a new 16-story office building now being erected in Toledo, Ohio, will be furnished by the F. Bissell Co., of that city. They will be one 160-kw, one 50-kw, and one 100-kw Northern generators, engine type. The F. Bissell Co. is district manager for the Northern Electric Manufacturing Company, of Madison, Wis., and handles a large trade in Ohio, Indiana and Michigan, which includes switchboards and other specialties of its own manufacture.

NEW STORAGE BATTERY FACTORY.—We are informed that on account of the great increase in the demand for its Bijur "high-duty" elements, the General Storage Battery Company has decided to enlarge its factory at Boonton, N. J., by erecting buildings furnishing an additional 48,000 sq. ft. of floor space, and to install hydraulic and steam or gas generating machinery, aggregating over 1,000 horse-power.

NEW WIRE PLANT.—At Worcester, Mass., the American Steel & Wire Company will add to its Worcester plant a building to cost $300,000. The addition is to be the electric cable works at the south mill.

CHICAGO TELEPHONE REPORT.—The annual report of the Chicago Telephone Company for the year ended December 31, 1905, shows as follows:

	1905.	1904.	1903.	1902.
Gross	$7,131,342	$6,373,116	$5,534,590	$4,570,806
Expenses	5,504,531	4,809,500	4,113,246	3,368,335
Net	$1,626,811	$1,563,616	$1,421,344	$1,202,471
Dividends	1,400,000	1,400,000	1,274,835	1,075,193
Surplus	$226,811	$163,616	$146,509	$127,278

The following interesting statistics are given in the Chicago Telephone Company's annual report:

	1905.	1904.	1903.	1896.
No. exchanges	156	111	114	31
Toll stations	57	80	81	68
No. exch. telephones	143,223	117,893	101,187	15,384
Underg'nd cond. miles	335	254	235	54
Underg'nd direct miles	1,755	1,468	1,372	185
Miles wire undergr'nd	187,231	161,202	149,234	20,548
Miles wire on poles	52,213	45,189	41,484	12,713
Total miles of wire	291,155	253,088	231,198	40,450

At the close of 1905, 143,223 subscribers' stations were in service, 25,330 more than at the end of 1904. Seven thousand six hundred and eighty-six stations of this increase are found in the suburban and rural districts in which the company operates in Illinois and Indiana. Telephones are installed in seldom less than 80 per cent and in many districts over 90 per cent of the farmhouses. To produce the net growth in 1905, 63,096 "In," or installation, orders and 37,766 "Out," or discontinuance, orders have been treated by the company in the departments. This treatment of 100,862 telephone stations resulting in a net increase of only 25,330 represents a feature of the telephone business which must be carefully reckoned with as telephones increase in the residences and places of business of the small users, many of whom are tenants. Eighty-four thousand two hundred and fifteen of the telephones now installed are for receiving service upon a message (or measured) rate basis. It would appear that the company's 58,000 pay stations are not particularly profitable.

CHESAPEAKE & POTOMAC TELEPHONE COMPANY.—The report of U. N. Bethell, president of the Chesapeake & Potomac Telephone Company, which has been forwarded to Congress, shows that the receipts of the company for the year 1905 were: Telephone earnings, $786,816.49; real estate earnings, $48,433.25; a total of $835,249.74. The expenditures were: General administration expenses and taxes, $101,336.11; traffic expense, $195,536.78; maintenance, $256,866.06; rentals and sundries, $41,458.88; real estate expenses, $57,832.97; interest charges, $103,245.12; a total of $756,295.92. The net earnings from all sources were $78,953.82, which less depreciation of $46,292.50, leaves a revenue balance for the year of $32,661.32. The receipts and expenditures on account of capital in the District of Columbia for the calendar year 1905 were: Receipts account of capital; proceeds of company's notes, $238,726.45; expenditures account of capital: For construction of underground conduits and cables, $120,087.26; for construction of poles, aerial wires and fixtures, $31,539.95; for central office equipment, $87,099.24; total capital expenditures, $238,726.45. Cost of work, not including real estate in the District of Columbia, December 31, 1905, $2,678,472.06.

CANADIAN GENERAL ELECTRIC.—Advices from Toronta say: "A few weeks ago the stock of the Montreal Power Company was listed in London and a considerable amount of British capital was attracted thereby. The Canadian General Electric Company has now followed the same line of action and has determined to go to England in the future for the enlistment of new capital. Large contracts have been offered this company, running into many millions, but so congested is the Canadian money market that the company has been unable to secure on anything like favorable terms the working capital necessary to enlarge its plants to Peterboro and Toronto in a way that would enable it to handle the new business offered. The company has been constantly expanding since it was taken over from American capitalists, in 1897, and now has a paid-up capital of $4,700,000. The present deal involves the sale of 11,000 shares of unissued stock at $120 and the entire block has been sold and the proceeds, $1,320,000, placed to the credit of the company. Under the arrangement the stock is to be listed in the London market and none of it will come on the Canadian market for a long term of years."

HOUSTON LIGHT & POWER.—Perry, Coffin & Burr and N. W. Harris & Co. are offering $300,000 of the first mortgage 5 per cent gold bonds of the Houston, Tex., Lighting & Power Company. These bonds are secured by a first mortgage on the company's entire property and franchises; the value of the physical property is largely in excess of the bonded debt; the company does the entire public and commercial electric lighting business in Houston, the largest city in the state, with a population of more than 65,000; the company's franchises are favorable and unlimited in time, and the net earnings are over four times the annual bond interest. Mr. A. H. Ford, the president, states that the property of the company is modern and in excellent condition. The power station is a brick and steel structure, with a generating capacity of 3,300 kw, including a 1,500-kw generator and turbine engine, recently installed. The physical property is, in point of value, largely in excess of the bonded debt (secured by closed mortgage). The company's capital stock is $500,000 preferred and $500,000 common. The surplus earnings in 1905 were $120,488.

ELECTRIC LINES COMPANY.—The New York Electric Lines Company, whose charter Attorney-General Mayer refused to annul, has elected officers and directors. The company controls a conduit franchise and through it the Great Eastern Company seeks to enter the telephone field in New York City. The following directors have been elected: George R. Bidwell, William Graves, Richard M. Montgomery, Wayne W. Wilson, Edward M. Millard, Herman G. Loew, Percival E. Jones, D. A. Reynolds and George Riley. The board elected William Graves president, Herman G. Loew vice-president, Wayne W. Wilson secretary, D. A. Reynolds treasurer and George R. Bidwell manager. The Coast Line Telephone Company of New Jersey, which is an ally of the Great Eastern Company, has filed an application for a franchise in Newark. The new company has 22,000 contracts where, it is alleged, the old Bell Company has only 19,000 telephones in the same territory.

DIVIDENDS.—The directors of the Western Telephone & Telegraph Company have declared the regular semi-annual dividend of 2½ per cent on preferred stock, payable February 1. The directors of the Cambridge Electric Light Company have declared a regular quarterly dividend of 2½ per cent, payable February 1. The Ohio Traction Company's directors have declared the regular quarterly dividend of 1¼ per cent, payable February 1. The directors of the Consolidated Car Heating Company, of Albany, have declared the usual semi-annual dividend of 1½ per cent. The United Traction Company's (Albany-Troy) directors have declared the usual quarterly dividend of 1¼ per cent. A regular dividend of 1¾ per cent has been declared on National Carbon preferred, payable February 26.

ELECTRIC BOND & SHARE.—The General Electric Company has sold to a syndicate headed by Lohrke, Rosen & Co. all its interest in the preferred stock of the Electric Bond & Share Company. The General Electric retains ownership of the common stock of the Bond & Share Company and President C. A. Coffin will continue to act as a director of the Bond & Share Company. This company was organized last year with a paid-up capital of $4,000,000 for the purpose of aiding in the financing of electrical enterprises such as electric railways and lighting and power transmission plants.

PHILADELPHIA BELL TELEPHONE.—The statement of Bell Telephone of Philadelphia for the year ended December 31, 1905 (December estimated) compares as follows:

	1905.	1904.		Changes.
Gross	$4,400,000	$3,756,060	Inc.	$643,940
Expenses	3,325,000	2,810,803	Inc.	314,197
Net	$1,275,000	$945,257	Inc.	$329,743
Dividends	899,068	836,010	Inc.	63,058
Surplus	$375,932	$109,247	Inc.	$266,685

CINCINNATI GAS & ELECTRIC.—The Cincinnati Gas & Electric Company has decided to increase its capital stock from $5,000,000 to $36,000,000. The increase is made in connection with the company's preparations to enter the natural gas field as indicated by the new franchise recently granted by the city council.

SOUTHERN NEW ENGLAND TELEPHONE.—The annual meeting of the Southern New England Telephone Company will be held January 30, at New Haven, Conn., where the stockholders will vote on the proposal to increase the capital stock of the company from 50,000 shares to 60,000 shares.

CHICAGO, ILL.—Northwestern Elevated extensions to Ravenswood and East Evanston are expected to make large earnings from the start. It is understood that for this purpose $1,000,000 treasury bonds available will be issued.

APPARATUS WANTED.—The town of Lexington, N. C., expects to furnish patrons with a day service, and is in the market for a 100-kw, 250-volt direct-current generating set, direct connected.

OREGON POWER DEVELOPMENT.—The Mount Hood Electric Company, organized to develop power from the waters of Big Sandy and Zig Zag glaciers, near the summit of Mount Hood, is inviting bids on machinery for a plant to generate 30,000 hp. The company has acquired several miles of riparian rights on the Sandy River, and surveys have been made for three plants, using the water of the stream three times on its descent of the mountain. The corporation is financed by a bond issue of $1,000,000 to the Bank of America, a San Francisco institution, and this sum is to be expended in construction of plant No. 2. The aggregate head secured at the three plants is 850 ft., divided as follows: 300 ft. at plant No. 1, 320 ft. at plant No. 2, 230 ft. at plant No. 3. The glaciers, at an elevation of 9,000 feet, furnish most of the water from July 15 to October 15, when Oregon rains begin. The incorporators are G. W. Waterbury, C. W. Miller and Edwin D. Whitney, and the company has organized with a directory of prominent business and professional men of Portland.

THE ELECTRIC CABLE COMPANY, of Bridgeport, Conn., which was recently organized with a capital stock of $500,000, has acquired a tract of land from vice-president George C. Edwards near the factory of the Bridgeport Chain Company and will utilize it as the site for a large plant. The plot has frontage of 265 feet on the tracks of the New York, New Haven & Hartford Railroad and of 250 feet on Central Avenue. The contract has been awarded for the erection of the first story of the plant which is to be constructed. The building will be a one-story brick structure with basement, and the dimensions will be 150 by 250 feet. The contract calls for the completion of the factory within ninety days. A minimum force of 100 workmen will be employed at the outset when manufacturing operations begin. The Electric Cable Company has absorbed the Wire Magnet Company of New York. It will manufacture wire cables, insulated wire, motors, armatures and all kinds of electrical machinery.

BOSTON ELEVATED CONTRACTS.—The Boston Elevated Company will increase its rolling stock and motor cars to the extent of 45 elevated and 37 surface cars. The elevated cars cost close to $10,000 each, making the total expense of the 45 cars $450,000. The surface cars are slightly less expensive, costing about $7,000 each, so the new surface equipment will involve an expenditure of about $260,000, making the entire cost of new rolling stock about $700,000. The new elevated cars will follow very closely the present cars, being made more nearly non-combustible. The Elevated Company for a number of years adhered closely to the 25-ft. car. The present policy is to increase the size of the car both in seating capacity and motive power. The General Electric Company and the Westinghouse Company are both bidding for the electrical equipment.

BELL TELEPHONE OUTPUT.—The American Telephone & Telegraph's instrument statement for December and twelve months compares as follows:

December—	1905.	1904.	1903.	1902.
Gross output	163,828	122,285	88,947	84,095
Returned	57,381	49,898	39,678	33,121
December net output	106,447	72,387	49,269	50,974
Twelve months' gross output	1,841,628	1,216,576	1,109,888	1,078,517
Returned	623,934	515,529	480,691	453,803
Twelve months' net output	1,217,694	701,047	629,197	624,714
Total outstanding	5,698,258	4,480,564	3,779,517	3,150,320

This means a total of 2,849,129 stations if all are in use, at the present time.

THE FORT WAYNE ELECTRIC WORKS, Fort Wayne, Ind., recently received an extraordinary order for meters. The order comes from the Commonwealth Company, of Chicago, and calls for 4,396 watt-hour-meters of the high-torque type. This is the largest single order the factory has received in years. A few weeks ago an order for 1,000 meters was received. The company is also installing an electric plant for the Superior Construction Company, at L'Anse, Mich., and a carload of machinery was shipped to that point recently. Among other recent orders was one for a carload of machinery shipped to the Pratt Ice Manufacturing Company, Pratt, Kan., in which was included a 1,400-light generator.

HEATING AND VENTILATING.—Among recent orders for heating and ventilating apparatus, the Sprague Electric Company has furnished complete equipments for the new U. S. Custom House, Senator Clark's residence and the Redman Bank Building, all in New York City, and for the town hall in Meriden, Conn. The Sprague Company has long made a specialty of electric equipments for operating heating and ventilating apparatus.

PLANT FOR STEEL MILL.—Milliken Brothers, 11 Broadway, New York, have placed orders for their new open-hearth steel plant and rolling mill on Staten Island, for the electric generators with the Westinghouse Electric & Manufacturing Company, and for the engines to operate the electric power plant to the C. & G. Cooper Company, Mount Vernon, Ohio.

CALIFORNIA ELECTRIC ROAD.—The Northern Electric Company, which proposes to build a standard gauge railroad from Chico to Oroville, Cal., with extensions to other towns, has doubled its capital to $6,000,000 and authorized $6,000,000 bonds for construction.

THE ELECTRIC CHAIN COMPANY of Attleboro, Mass., and B. L. Colvin & Company, of Providence, R. I., have consolidated, and announcement is made that the business of the latter concern will be moved from Providence to Attleboro.

CATALOGUES WANTED.—Mr. Robert Anderson, 175 Sparks Street, Ottawa, Ontario, Canada, is desirous of procuring catalogues from manufacturers of dynamos, motors and electrical supplies.

Financial Intelligence.

THE WEEK IN WALL STREET.—There was considerable activity and a bullish feeling in stock speculation, due to easier money conditions and sanguine views as to the effects of existing favorable business conditions. Iron and steel shares were very strong. In the railroad list attention was divided between the high-priced standard stocks and the specialties, and among the industrials there was a tendency to take hold of stocks which have not received any great share of favor in the recent past. In the traction list Brooklyn Rapid Transit developed strength and showed manipulative support, while the Metropolitan group was inclined to slump on the introduction of a bill at Albany, apparently having for its purpose the prevention of the merger between the Metropolitan and the Interborough interests. The sales of Brooklyn Rapid Transit ran up to 204,500 at prices ranging between 90 and 92¾, the closing quotation being 91⅛, which is a net decline of ⅜ point. Metropolitan Street Railway closed at 125, thereby losing ⅝ point net, while Interborough Rapid Transit made a gain of 2½ points (on the curb market), the closing quotation being 235½. There was comparatively little business done in the electric shares, Allis-Chalmers common closing at 23⅛ and preferred at 63⅜, these quotations representing a net gain of ⅜ in the first case and a net loss of ⅜ in the second. General Electric lost one point on the week's business, closing at 178, and Westinghouse 1⅛ point, the last quotation being 173. The closing price for American Locomotive common was 76¾ and for preferred 119¼, these figures representing a net advance of ⅜ and a net decline of ⅜, respectively. Western Union closed at 93½ and American Telephone & Telegraph at 143, the latter being a net advance of 6½ points. The curb market participated in the enthusiasm of the Stock Exchange during the week and several stocks became active with some substantial advance, Mackay Companies' shares being among them. Trading in contracts of the new Metropolitan Traction Company suddenly ceased, following the proposition to change the character of the terms which are to be offered to shareholders of the subsidiary companies. Following are the closing quotations of January 23:

NEW YORK

	Jan. 16	Jan. 23		Jan. 16	Jan. 23
Allis-Chalmers Co	23⅛	23⅜	General Electric	178	178
Allis-Chalmers Co. pfd	63¼	65¾	Hudson River Tel.	...	..
American Dist. Tel	37	37	Interborough Rap. Tran	233½	234
American Locomotive	76⅜	72⅝	Mackay Cos.	60	62¾
American Locomotive pfd	119	118	Mackay Cos. pfd	74	75
American Tel. & Cable	91	80	Marconi Tel.	...	..
American Tel. & Tel.	138	140	Metropolitan St. Ry.	126⅛	124¼
Brooklyn Rapid Transit	90¾	91¾	N. Y. & N. J. Tel.	...	..
Electric Boat	28	25	Western Union Tel.	93⅜	93½
Electric Boat pfd	65	60	Westinghouse com.	170	171
Electric Vehicle	15	15	Westinghouse pfd.	...	..
Electric Vehicle pfd	21	21			

BOSTON

	Jan. 16	Jan. 23		Jan. 16	Jan. 23
American Tel. & Tel	138½	141	Mass. Elec. Ry. pfd	69	68¾
Cumberland Telephone	117	117¼	Mexican Telephone	..	3¾
Edison Elec. Illum	250	...	New England Telephone	137½	139
General Electric	...	...	Western Tel. & Tel.	15	15
Mass. Elec. Ry	18⅝	18⅜	Western Tel. & Tel. pfd	..	96

PHILADELPHIA

	Jan. 16	Jan. 23		Jan. 16	Jan. 23
American Railways	52	53¾	Phila. Electric	8⅛	8
Elec. Co. of America	12	12	Phila. Rapid Trans	32⅝	32¾
Elec. Storage Battery	83	85	Phila. Traction	...	...
Elec. Storage Battery pfd	...	...			

CHICAGO

	Jan. 16	Jan. 23		Jan. 16	Jan. 23
Chicago City Ry	197	...	National Carbon	80¾	.
Chicago Edison	...	...	National Carbon pfd	117	..
Chicago Subway	...	51½	Union Traction	...	..
Chicago Tel. Co	...	...	Union Traction pfd	...	..
Metropolitan Elev. com	28	...			

General News.

SAN FRANCISCO, CAL.—A movement is on foot among the merchants about Union Square to erect fancy poles along the edge of the park so as to add to the beauty of the locality. Each pole is to carry eight 32-cp electric lamps inclosed in large white glass globes. The poles will be of ornamental iron and cost $100 each. The expense of putting in the ornamental fixtures is to be paid for by the property owners, but the tenants are expected to pay the operating expenses.

SAN FRANCISCO, CAL.—An interesting point in connection with the recent purchase by the California Gas & Electric Corporation, of this city, of a 9,700-hp single horizontal, spiral case, reaction hydraulic turbine, is contained in the fact that this turbine will operate under a head of 550 feet at a speed of 400 r.p.m., which is the highest head under which a turbine of this type has ever been installed. This turbine and accessories will be furnished by the Allis-Chalmers Company, of Milwaukee, and is destined for installation at Chico, Cal., where the Corporation controls the water rights.

SANTA CRUZ, CAL.—John Martin and Eugene de Sabla have purchased from Fred W. Swanton and his associates the Co-operative Electric Light Company, of this city. It is understood that Martin and de Sabla take all of the stock of the company for $100,000. This company furnishes electric light to the main part of Santa Cruz. This is the second lighting company in the city which Messrs. Martin and de Sabla have purchased within the last few weeks, the first one being the Santa Cruz Electric Light & Power Company for which they are said to have paid $110,000. That company furnishes power for the Santa Cruz electric roads, as well as electric lights. It is also reported that the gentlemen are seeking to purchase the Big Creek Power Company, which has a hydro-electric power plant in the Santa Cruz Mountains. This company furnishes lighting for Watsonville and other surrounding towns, also power for several electric roads. By these deals, Messrs. Martin and de Sabla will have almost entire control of electric lighting and power interests in Santa Cruz County, as they already have throughout central California and in the Bay counties.

GOLDFIELD, COL.—The Pueblo & Suburban Traction & Lighting Company, of Pueblo, is reported to have secured the contract for lighting the city for five years at $12 per month per arc lamp.

PLAINVILLE, CONN.—At the recent special town meeting, the selectmen were authorized to spend not more than $1,500 for street lighting. This is an increase of $400 over the last appropriation.

NEW HAVEN, CONN.—The contract for the construction of the electric railway between Seymour and Naugatuck has been let by the Connecticut Railway & Lighting Company to D. W. Blakeslees' Sons, of New Haven.

YALESVILLE, CONN.—A petition has been prepared and presented to the selectmen of Wallingford requesting that a special meeting of the citizens be called to consider the organization of a district scheme for lighting the streets of Yalesville.

DARIEN, CONN.—At a meeting held recently to consider the question of establishing a street lighting system, the impression seemed to prevail that application should be made to the Legislature for authority to bond the town for the purpose.

ROCKVILLE, CONN.—The Hockanum Company, manufacturers of worsted and woollen goods, will hereafter be operated by electric power. Each floor will be equipped with an independent motor. The concern is now installing two new Bigelow boilers. An electric lighting plant has just been established.

NEW BRITAIN, CONN.—The Connecticut Railway & Lighting Company has discontinued its power plant on Chestnut Street, this city, and all of its power for lighting and traction purposes for this district is now obtained from the sub-station at Black Rock in the western outskirts of the town. Electricity is transmitted to the sub-station from the New Milford Power Company's plant on the Housatonic River in Litchfield County, a distance of about 40 miles. The Chestnut Street plant will not be dismantled for the present, but will be retained for emergency purposes. Three sub-stations, located at Black Rock, Cheshire and Waterbury, are now supplying various districts of the Railway & Lighting Company's system with power generated at Bulls Bridge on the Housatonic. The company has a 30-year contract with the New Milford Power Company.

CHICAGO, ILL.—The Chicago & Southern Traction Company is seeking to increase its capital stock from $100,000 to $2,000,000.

CHICAGO, ILL.—The directors of the Metropolitan Elevated Railroad have appointed a committee to take up the question of providing additional power.

HEYWORTH, ILL.—Two telephone exchanges and a number of business houses were destroyed by fire here recently. The total loss is estimated at $50,000.

PLAINFIELD, IND.—A new telephone service between Plainfield, Clayton and Brownsburg is being established by the Central Union Telephone Company, and exchanges are being installed at all three places, at a cost of about $20,000.

LAWRENCEBURG, IND.—A company of local capitalists, headed by W. H. O'Brien, is seeking a franchise to operate a combined electric light and power plant and water works system. It is believed that the petition will be granted.

HARTFORD CITY, IND.—The Central Union Telephone Company's exchange has been combined with that of the United Telephone Company, and hereafter the business of both companies will be transacted from the one office in the building of the latter company.

EVANSVILLE, IND.—The revised proposition of the Cumberland Telephone Company in the form of a new franchise has been received and filed. An abstract of the important features of the franchise follows: "The rights and privileges herein granted to the said Cumberland Telephone and Telegraph Company shall be for a period of forty-five years; twenty-three free telephones for the use of the city; the city is allowed the exclusive use of two feet of one arm on each pole for its fire alarm telegraph wires. The company agrees to make connections with all farmers' lines in Vanderburg County, and free connection to the patrons of the Evansville exchange with such farmers' lines.

MUSCATINE, IA.—Reports state that the electric light and gas plants, together with the street car system, all of which belonged to local parties, have been sold to a syndicate represented by J. H. Brown and George Mayer, of Chicago. The consideration is said to have been $750,000.

TOPEKA, KAN.—The Topeka Edison Company, at its annual meeting, elected the following directors: B. E. Sunny, L. E. Myers, E. W. W. Wilson, George H. Taylor, George B. Caldwell, E. A. Potter, Jr., M. A. Low, J. E. Hurley and W. A. L. Thompson. The gross earnings of the company for 1905 were reported to be $173,527 and operating expenses of $94,978, leaving net earnings of $78,540.

NEW PROVIDENCE, KY.—C. W. Kelly, of Jeffersonville, Ind., has petitioned the Town Board for an electric light, heating and power franchise.

ACKLEY, LA.—The city has voted to accept the gift of John Rath, whereby it comes into possession of a municipal electric light plant valued at $10,000. A competent superintendent will be placed in charge of the plant.

SOUTH ACTON, MASS.—A plan is being formulated to have this village lighted with electricity.

WESTBORO, MASS.—The Selectmen are said to be considering the construction of an electric light plant.

HAVERHILL, MASS.—Inspector of Wires Corson advocates strongly the putting underground of all electric wires as soon as it can be accomplished. In the meantime he would recommend a more thorough inspection of the present overhead systems.

SPRINGFIELD, MASS.—If the Heath Telephone Company secures the franchise in Whately, for which application has been made, it will make connections at the county line with the Citizens' Independent Company, but it is not proposed to consolidate with that company.

CHICOPEE, MASS.—Many of the aldermen are not anxious to serve on the committee to investigate the electric lighting plant conditions. The Mayor in his inaugural address declared the electric lighting plant to be in fine condition, but later had the order introduced looking toward an investigation.

DUXBURY, MASS.—The town will soon have its streets lighted by electricity for the first time. A company of local capitalists has been formed and a franchise to erect poles and string wires will be asked for immediately. A power plant will eventually be erected, but it is stated that until next summer current will be taken from Plymouth. It is proposed to extend the system to the summer colonies at Brant Rock and Green Harbor, and it is not improbable that a section in Marshfield will be furnished with light.

FALL RIVER, MASS.—Chapter 34 of the revised laws under authority of which attempt is being made to secure municipal ownership of gas and electric lighting, provides that any proposition of this character must receive a two-thirds vote of the members of the city government for two consecutive municipal years, after which the decision must be ratified by a majority of the voters at the annual or a special city election. If Alderman Manley's order gets by the government this year it will be necessary for favorable action on the part of the government of 1907 before the proposition reaches the people.

BAY CITY, MICH.—The Pere Marquette Railroad Company is preparing to light its premises by electricity. Dynamos and boilers will be installed in the new warehouse now being constructed.

LUDINGTON, MICH.—The Stearns Lighting & Power Company announces that during the year 1905 it added 150 customers. In view of the gas competition it offers two months lighting free to all parties wiring up between now and March 1.

GRAND RAPIDS, MICH.—It is rumored that plans are on foot for the consolidation of the Edison Company and the Grand Rapids-Muskegon Electric Water Power Company, the concern which is building a $300,000 dam on the Muskegon River. Should this deal go through it will eliminate all competion and the Edison Company will retain its supremacy in this city.

GRAND RAPIDS, MICH.—In a report made by General Manager Samuel A. Freshney, of the municipal lighting plant, covering the last four months of 1905, it was stated that for that period the total number of lamps in circuit was 727 as against 701 during the same period of the previous year. It also showed the cost of operation to have been reduced from $9,688.73 to $8,500.01.

MINNEAPOLIS, MINN.—City Engineer Andrew Rinker has submitted a report to the Water Works Committee which does not favor utilizing the water power controlled by the city for the operation of an electric light plant for the courthouse and city hall. He figures that it will

cost more to convert the two lower pumping stations into power plants and operate them than it does to run the present electric plant in the courthouse, and that it would cost $18,250 a year to maintain the plant after it was installed. The present system costs $15,405 a year, a difference of $2,845. Mr. Rinker said it might be possible to utilize the water power in operating about 300 arc lamps for street lighting purposes, but he would not recommend the plan, saying if the city was going into the lighting business there should be one large central plant of sufficient capacity to light the entire city. An effort will be made to dispose of the city's water power rights or at least make some arrangement whereby the city will be relieved of the payment of $4,000 annually for power that is not used.

ST. LOUIS, MO.—The Edison Illuminating Company held its regular stockholders' meeting January 18 and re-elected the following-named directors: Henry C. Scott, S. W. Fordyce, W. S. Scott, Horace W. Beck and E. V. Matlock.

CLINTON, MO.—The Council has voted to put the question of municipal ownership of the light and water systems before the people. A special election will be held February 16. The people will be asked to vote bonds to the amount of $30,000 for the light and $70,000 for the water plant.

PASSAIC, N. J.—Mayor Greenlie has signed the contract giving the Public Service Corporation the lighting of the city for five years, with 2,000 cp street arc lamps at the cost of $85 and the commercial light at 12 cents per kw-hour on a sliding scale to 10 cents for the last year of the contract. This ends what was one of the longest and bitterest lighting fights in the State. A year ago the Public Service offered to supply the city with lights for $77.90 per annum, and commercial light for 12 cents, but the Weehawken Company war was on at the time, and the feeling was so bitter against the Public Service that the offer was not accepted.

ROME, N. Y.—The Thousand Island Electric Light & Power Company has filed its annual report, showing the capital stock to be $25,000, all paid up, liabilities not exceeding $10,000, and assets of at least $20,000, all of which constitutes a very good showing for the company.

OWEGO, N. Y.—The Owego Light & Power Company has elected officers as follows: William S. Truman, president; Hon. W. G. Phelps, vice-president; George F. Andrews, secretary and treasurer; Horace Yothers, superintendent.

NIAGARA FALLS, N. Y.—A meeting of the stockholders of the Niagara, Lockport & Ontario Power Company has been called to be held at Lockport on January 30. Action will be taken on a proposition to alter the certificate of incorporation of the company so as to extend its business and to include purposes, power and provisions, in addition to those now held.

HAMLIN, N. Y.—At the annual meeting of the stockholders of the Hamlin Telephone Company the following officers were elected for the ensuing year: President, D. R. Singleton; vice-president, John Martin; secretary, Isaac Palmer; treasurer, Charles Baase. It was unanimously voted to continue construction work until the system extends to all parts of both towns. A large switchboard will be installed to accommodate the increasing number of subscribers, and copper wires will be run on its trunk lines from Brockport to Troutburg, Morton, East Hamlin and Sunnyside Beach, with a central office at Hamlin and another at Brockport.

GRAND FORKS, N. D.—C. P. Trepanier has made arrangements with H. Fant, manager of the local exchange, to connect with the Tri-State Telephone Company, which will build a line from Ardoch to Thief River Falls along the Soo. The company expects to build a line the full length of the Soo extension as far as Kenmare. The Northwestern Company has taken its long-distance connection out of the Thief River Falls exchange, and will ask for a franchise for a new system at that place.

ELYRIA, OHIO.—The Elyria Southern Telephone & Toll Company has increased its capital stock from $40,000 to $75,000.

LORAIN, OHIO.—The Lake Shore Electric Railway, which controls and operates the Lorain Street Railway, is making important improvements to the line between Lorain and Elyria. Portions of the line are to be double tracked, ten new cars installed and the city service much improved. The old direct-current generating machinery has been shut down and the line will be operated from rotaries installed in the old power station.

CINCINNATI, OHIO.—Keen competition for a telephone franchise in Cincinnati is promised. The Interstate Telephone Company, operating in Kentucky, has applied to the Council for a franchise, and Attorney Powel Crosley, for the Cincinnati Telephone Company, asked for a postponement of action on other franchises for a week or ten days until his company could prepare its application. Application has also been made by the Queen City Home Telephone Company.

COLUMBUS, OHIO.—According to Superintendent Willcox's report during the year 1905 the city was lighted by an average of 1,500 street lamps at an alleged average cost of $49 per lamp, while under contract the cost was $74.50. The total cost for operating the plant during the year was $34,400. It was estimated at first that $65,000 would be needed and an appropriation was made covering that amount. The allowance for depreciation does not appear.

TOLEDO, OHIO.—The Toledo Railways & Light Company at its regular annual meeting re-elected the present officers and directors with the exception that Charles W. Wason, of Cleveland, and W. L. McKenna, of New York, were elected directors in place of Messrs. Barton Smith and H. S. Holt. Contracts have recently been closed for two 3,000-kw Curtis turbines to be connected to alternating-current generators, two 1,000-kw rotary converters, one 1,000-kw motor-generator set, and four 700-hp boilers. A large extension to the storage battery station will be installed.

CLEVELAND, OHIO.—The Cleveland Electric Illuminating Company will supply arc lamps to the city at $69.72 per lamp during 1906, which is a reduction of nearly four dollars from the old rate. The reduction is doubtless due to the fact that the city has acquired a plant of its own with the annexation of South Brooklyn, and it was suggested that the entire city might be lighted from that plant if the lighting company did not make a better rate. The reduction means a saving to the city of about $5,000, which will be used to purchase additional electric light equipment. The acquisition of the South Brooklyn lighting plant is regarded as an opening wedge toward municipal ownership in Cleveland. Upon the urgent representations of Mr. Springhorn, Director of Public Service, the committees put into the budget an appropriation of $56,000 for the plant. Of this $40,000 is for new buildings and machinery, $10,000 to carry wires and poles across the bridge so as to light the southwestern part of the city, and $6,000 for the cost of operating.

WILKESBARRE, PA.—The mayor has recommended in his annual message the construction of a municipal lighting plant.

PLYMOUTH, PA.—The new electric light plant of the Wyoming Gas & Electric Company has been successfully put in operation. The plant is one of the largest and best equipped in this part of the State and the company, which has heretofore been hampered for lack of power, will now be able to meet all demands with an improved quality of service.

SUNBURY, PA.—The Middle Creek Electric Light Company, composed of Northumberland and Snyder County capitalists, has purchased the Edison light plant in the town of Northumberland. This is said to be the first commercial light plant in America, having been installed by Edison himself, who until quite recently held a block of the company's stock.

PHILADELPHIA, PA.—The Bell Telephone Company has opened a new exchange at Fourth and Manning Streets, which will be called "Lombard." This was made necessary by the increased demands in the Market central office. All subscribers south of Walnut Street and east of Sixth Street will be transferred to the new exchange. The new central is a four-story building of granite and brick. The interior is finished in selected white quartered oak and the equipment comprises the latest developments in telephone apparatus. A feature of the place will be a school for operators.

PHILADELPHIA, PA.—The Philadelphia Electric Company has taken title to the plant of the Southern Electric Light & Power Company at 26th and Chestnut Streets. The plant, which is the largest in the city, consists of four power houses, an office building and repair shops, and is valued at $450,000. Officials of the Philadelphia Electric Company have declined to make any statement concerning the transfer, but it is understood that the real estate covering the fourteen plants scattered throughout the city, which have retained their corporate existence, although controlled by the one company, will now be conveyed to the parent company.

YORKVILLE, S. C.—The Catawba Power Company is now furnishing power for the operation of the Tavora Mills, of this place.

GAINESVILLE, TEX.—At the annual meeting of the Gainesville Merchants' Electric Light Company, the following officers were elected: E. J. O'Bierne, president; Charles A. Zilker, vice-president; W. H. O'Bierne, secretary and general manager; W. L. Grennhill, treasurer.

BELLINGHAM, WASH.—The Columbia Improvement Company has let a contract to the Platt Iron Works Company, of Dayton, Ohio, for furnishing the 3,300-hp turbine which will be installed at the Nooksack Falls power plant. The cost will approximate $12,000.

RAMPART, WASH.—The construction party of men in the Signal Corps have completed a new telegraph line along the Highland of the Yukon, between Rampart and Fort Gibbon. This permits the abandonment of the section between Baker and Gibbon, which was exceedingly difficult to maintain in summer, owing to the extensive swamps of the lower Tanana.

SEATTLE, WASH.—According to local press reports, the city lighting plant is proving a costly luxury. The total revenue from sale of current during the month of December, 1905, is said to have been less than $1,000. More than three-quarters of a million dollars have been spent in the construction of the plant, toward which the people voted in 1902 for a bond issue of $590,000. It is probable that another issue of bonds will be asked for, as at least $300,000 will be needed for the construction of new lines if the city is to compete on even terms with the established electric light and gas companies.

DEPERE, WIS.—The Green Bay Gas & Electric Light Company, of Green Bay, has petitioned for a franchise to operate in Depere.

NELSON, B. C.—According to figures given out by the city officials, the first year of municipal control of the street railways in this city has resulted in a loss of $5,663.70. The city took over the railway at the beginning of 1905 on a lease of three years. The cost of running the system proved to be $9,000, while the receipts were less than $6,000. The cost of power alone was $2,400. Some time during the current year the city hopes to be in position to supply power from the municipal electric light plant at a nominal cost.

WINNIPEG, MAN.—During 1906 the Bell Telephone Company will make special efforts to give Manitoba and other western farmers the benefits of telephone connection. The company will either build the line and give service on a yearly rental basis, the same as in Winnipeg or on other local exchanges, in which case the farmer has free service

to and from the local exchange, or it will connect its local and long-distance lines with systems built by the farmers themselves, and will, in this case, give expert and financial assistance to farmers who prefer to supply their own service. The Bell Company now has eighty-five exchanges and toll offices in Manitoba, and thirty additional are now under course of construction. Other extensive additions and extensions will also be made this year. It is expected that during 1906 thousands of farmers will be added to the local exchanges throughout the province.

MEXICO CITY, MEX.—The corner stone of the central exchange building of the New Telephone Company has just been laid with appropriate ceremonies. It is hoped to have the exchange open for business in about three months. More than half of the entire underground system is now laid, most of this being in the central portion of the city, and the company is now pushing work on the outlying sections.

BERLIN, ONT.—The question of provincial operation of the telephone system is being agitated here. A petition has been prepared and forwarded to the Legislature, urging the Government to take into immediate consideration the matter of establishing such a service.

OTTAWA, ONT.—With the failure of the Fox River as a source of water power, the Ottawa Hydraulic Company found itself without natural resources. For some time negotiations have been on foot whereby the Northern Illinois Light & Power Company, controlling the electric lighting and street railway utilities, has obtained from the Canal Commissioners a lease of the water coming down the canal and into the "side-cut." As the Hydraulic Company's rights rested solely on such water as came through the Fox River feeder, which is now extinct as a water course, there was nothing left for the latter company except to make such terms with the electric company as it could.

Construction News.

WATKINS, ARK.—A 20-year franchise for an electric light plant has been granted to B. F. Hill. The plant will be located at the roller mill in the eastern part of town.

FORT SMITH, ARK.—The City Council has granted to the Interurban Traction Company an extension of one year in which to begin work, making the third extension since the company was incorporated two years ago. E. B. Miller, of the Commercial Club, is said to have interested Memphis capital in the enterprise. The work is to be commenced within twelve months, and three miles are to be completed eight months thereafter.

ROGERS, ARK.—The Rogers Electric Light, Heat & Power Company, installed here last spring, has been consolidated with the Rogers Motor Co., and reincorporated as the Rogers Light & Motor Co. The new company will double its capacity by installing a new 200-hp boiler and a 150-kw dynamo. By April it is hoped to have in successful operation a good day load. Mr. J. L. Dunn has been retained as general manager by the new company.

LOS ANGELES, CAL.—The Los Angeles & Rodondo Railway Company is preparing to install a new power plant.

SAN DIEGO, CAL.—The San Diego Electric Street Railway system is to increase the capacity of its plant.

PASADENA, CAL.—The Pacific Electric Railway Company is planning improvements and extensions here that will necessitate building more than a dozen miles of trackage in the near future.

CHICO, CAL.—Bids in writing will be received by the Board of Supervisors of Butte County, at Oroville, February 10, for the purchase of an electric light franchise, as applied for by J. A. Foster.

REDDING, CAL.—The actual work of surveying for the electric road between Red Bluff and this city will be commenced very shortly. The temporary headquarters of the surveying crew will be at Red Bluff and the work will be rushed along as rapidly as possible.

VALLEJO, CAL.—Col. J. W. Hartzel, of this city, announces that the new San Francisco, Vallejo & Vaca Valley Electric Railroad & Steamship Company has been financed with the aid of English capital and that the road, which will approximate 100 miles in length, will be built during this year.

STOCKTON, CAL.—The directors of the Central California Traction Company have authorized a bond issue of $1,500,000, to build and operate the new Stockton Electric Railroad system and the interurban lines projected. Eight and half miles of track have been laid in Stockton by the company this winter, and franchises call for extensions to Lodi and Woodbridge in the northern part of the county.

SAN DIEGO, CAL.—It is understood that plans are well under way for the establishment of an electric lighting plant at La Jolla for the purpose of supplying light and power to that town and Pacific Beach. The new company is said to be composed of Los Angeles capitalists. Part of the machinery has been ordered, it is said, and the company claims that it will be able to furnish electric lights within ninety days after the franchise applied for has been granted.

HAYWARD, CAL.—As a result of the many complaints made by citizens of this town regarding the poor quality of electric lighting which has been furnished by the Suburban Electric Company, there is a probability that the company will in the near future furnish its own power. Heretofore the Suburban Electric Company has been getting its electric power from the Standard Electric Company. Reports state that the Suburban Company will erect a plant on the bay shore.

REDDING, CAL.—The Shasta County Board of Trade has been notified of the intention of the Boston syndicate, promoted to Alonzo Cloaver, to construct an electric railroad from Redding to Weaverville, and thence to the Pacific Coast. Two surveys have already been made. The work is to commence as soon as the road of the same company now being built out of Union, Ore., is well under way. Trinity and Shasta counties will give moral and financial support to the new road here, which will be extended to other towns along Bayou Teche.

LOS ANGELES, CAL.—Representative Smith has introduced a bill in Congress granting the Edison Electric Company of Wyoming, with headquarters in this city, the right to occupy and use lands for construction and operation of power plants in San Bernardino, Sierra and San Gabriel forest reservations and to divert the water of Mill Creek, Santa Ana River, Lyttle Creek and Kern River. Permits to this effect have heretofore been granted by the Agricultural and Interior Departments. The bill is designed to afford electric power for lighting and traction purposes in a number of cities in Southern California.

FT. MORGAN, COL.—The citizens have decided to construct a municipal electric light plant.

NORWALK, CONN.—The town of Norwalk has installed the necessary equipment for the electrical operation of the Washington Street drawbridge over the Norwalk River, at South Norwalk.

BRIDGEPORT, CONN.—The Connecticut Railway & Lighting Company has decided to double track its recently completed Cheshire trolley line, running from New Haven north toward Hartford. The company has also promised to open a service between Meriden and Waterbury via Cheshire, in the near future.

NEW LONDON, CONN.—The Board of Water Commissioners of the Borough of Groton has practically decided to whom the contract for furnishing the remaining equipment of the new power house will be awarded. The contract for furnishing the generators and other electrical equipment has been awarded to the Crocker-Wheeler Company. The contract calls for delivery in ten weeks and the price to be paid is $6,200. In addition to supplying a 160-kw generator the contract includes motors, switchboard and all the inside wiring of the power house. The plant will probably be ready for operation by May 1. The machinery will be ready inside of ten weeks and the structure will be far enough along in that time so that the machinery can be installed without delay.

DOVER, DEL.—The Diamond State Telephone Company has decided to extend its lines from Kenton to Down's Chapel and thence to Hartley. Also from Felton to Viola and Greenwood.

WILMINGTON, DEL.—It is reported that estimates are now being prepared for the proposed plant of the Wilmington Heat, Light & Power Company. The cost of construction is estimated at $500,000.

WILMINGTON, DEL.—Charles C. Krutz, president of the new Wilmington Heat, Light & Power Company, confirms the reported purchase of the Braywine storehouse of the Jessup & Moore Paper Company. The company will at once secure plans for the construction of a modern power house and the entire plant will cost, it is said, about $500,000.

DOVER, DEL.—The Diamond State Telephone Company will establish an exchange at Harrington, the centre of the great Delaware small fruit belt. General Manager Baker has approved the plans for the extension of a trunk line from Viola southward probably to Shelbyville, passing through Felton, Farmington, Greenwood and Bridgeville. Harrington will be the central point for this service.

WEST PALM BEACH, FLA.—Dr. J. E. Liddy and associates have applied for a 20-year franchise to establish and operate a telephone system to cost not less than $5,000.

ROCKMART, GA.—The citizens have voted to issue bonds for an electric light plant.

ELBERTON, GA.—It is proposed to install at the electric light plant a 125-hp engine and a 75-kw, 133-cycle, two-phase alternator.

CANTON, GA.—W. A. Carlisle, of Gainesville, Ga., is engineer for the proposed light and power plant, to be constructed on Etowah River.

COCHRAN, GA.—Bids will be received by W. B. Denham, City Clerk, until February 6, for water tower, fire pump, boiler, generator and engine, for the water and lighting plant.

CARLTON, GA.—L. F. Edwards, of Athens, is reported to be preparing to develop Watson's Shoals on Broad River, and will transmit the current to Carlton, and erect a cotton factory; probable cost of work proposed $100,000.

SAVANNAH, GA.—The Savannah Light Company, at its recent meeting, decided to build a new conduit from the power house to connect with the underground system at Witaker Street and York Lane, a distance of two miles. The cost of the work is estimated at $16,000.

WALLACE, IDA.—The Mullan Electric Light & Power Company is reported to have petitioned the City Council for a franchise.

BOISE, IDAHO.—The Independent Long Distance Telephone Company contemplates making improvements which will involve an expenditure of from $60,000 to $80,000 upon its plant in Boise. The new exchange and office building, now well under way, will cost upwards of $15,000, and will be a model structure for the purpose for which it is intended. The new switchboard will cost over $20,000 and equipped for a four-party selective ringing system. It is to have a capacity of 6,000 lines. A new switchboard and other facilities for rural lines will also be installed.

WAUKEGAN, ILL.—The North Shore Electric Company is planning to construct a power plant on the lake front at Waukegan, to cost about $50,000.

JACKSONVILLE, ILL.—It is said that $18,000 has been appropriated for the construction of a municipal electric light plant. Edward Brown is the engineer.

AURORA, ILL.—Plans are on foot to connect the large Catholic cemeteries with the railroad at Bellewood. The cost of the proposed extension is about $100,000. The Aurora-Chicago Railway Company is behind the project.

AURORA, ILL.—Plans and estimates are being prepared for the construction of a municipal electric light plant, to cost about $10,000. C. C. Hinckley is city electrician.

CHICAGO, ILL.—The Chicago Telephone Company has plans for a new 16-story building for exchange and office purposes. The company shows gross income, $7,131,342; expenses, $5,504,531; net, $1,626,811; surplus, $226,811.

GALESBURG, ILL.—The Central Railway Company, of Peoria, is said to have transferred 90 per cent of its stock to the McKinley Syndicate. The new company will shortly commence the construction of a new 15,000-hp electric plant in Peoria.

MONON, IND.—The Town Board is reported to have granted to A. A. Wallace a 25-year franchise for an electric light plant.

FT. WAYNE, IND.—The Kerr-Murray Manufacturing Company, Ft. Wayne, is making arrangements to erect a new electric power plant.

NORTH VERNON, IND.—The North Vernon Independent Telephone Company has asked the City Council for a modification of its franchise so as to permit it to increase the present telephone rates of $1 and $2, for residences and business houses respectively. The company has decided to expend $17,000 in adding to its equipment during the coming year.

MILL CREEK, I. T.—The City Council has granted the Mill Creek Electric Light & Power Company a franchise to establish a lighting system.

MARSHALLTOWN, IA.—The Peterson Light, Heat & Power Company may erect a municipal heating plant here.

OSKALOOSA, IA.—The Oskaloosa Light & Fuel Company has been purchased by the Heald-Stevens Company, of Grand Rapids, Mich.

AFTON, IA.—It is reported that bids will be received until Feb. 12 by the Lighting Committee, of which E. A. Lee is chairman, for an electric light plant.

DES MOINES, IA.—At the annual meeting of the Western Electric Telephone Company, the expenditure of some $200,000 in improvements during the coming year was authorized.

DES MOINES, IA.—The Mutual Telephone Company, of Des Moines, during the coming year, contemplates expending about $30,000 in stringing and laying cables. During the past two years the company has spent over $500,000 in improvements. The expenditures for 1905 were given out as $375,000.

BURTON, KAN.—The matter of an electric light plant is being agitated in this town and a local company will probably be organized.

SCRANTON, KAN.—A meeting has just been held here with reference to securing an electric light system for the town, and definite steps to that end will be taken soon.

COFFEYVILLE, KAN.—The Kansas & Southern Electric Railroad is said to be planning to build to Coffeyville. L. F. Mitchell and Paul Fuzz, of St. Louis, are backing the project.

PITTSBURG, KAN.—The Home Light, Heat & Power Company has awarded to W. T. Osborn & Company, electrical engineers, of Kansas City, Mo., the contract for its electric light plant.

MIDWAY, KY.—B. S. Kincart, of Campbellsville, has petitioned for a franchise for an electric light plant.

HOPKINSVILLE, KY.—The Clarksville Electric Light & Railway Company has placed an order with Eastern firms for machinery for its power plant valued at between $50,000 and $60,000 for March delivery.

LOUISVILLE, KY.—Lawrence Jones, Peter Lee Atherton and others have petitioned the Council for a franchise to construct a electric light plant in that section of the city bounded by the river, Broadway, Brook and 6th Streets.

PRINCETON, KY.—An ordinance will be presented at the next Council meeting, authorizing the sale of a franchise to the highest bidder for an electric street car system, and a power, heat and lighting plant. Eastern capitalists are interested.

NEW IBERIA, LA.—A 25-year franchise has been granted to A. F. Augur to operate an electric street railway system in New Iberia. The work is to be begun within five months. It is expected that the line will be expended to other towns along Bayou Teche.

LAFAYETTE, LA.—It is proposed to soon install at the municipal electric light plant a series alternating-current arc system of about 75 lights and to use alternating current on the suburban districts; also a 150-hp boiler and about two miles of incandescent lines. Charles J. Miller is superintendent.

ELLSWORTH, ME.—The Bar Harbor & Union River Power Company is reported to have purchased the lower dam on Union River, and it is stated that permanent work will commence in a short time.

BANGOR, ME.—President John R. Graham, of the Bangor Railway & Electric Company, announced that a new dam will be built at the Veazie Power Station of the company the coming season, across the Penobscot River. The dam will be of concrete and an important addition to the water power development of the river. The company will expend $150,000 in improvements this season.

DEXTER, ME.—The committee on investigating the electric light situation does not report a great deal of headway. It is now pretty well understood that there is a stumbling block in the way of getting power from the plant of the Sebasticook Power Company at Pittsfield. In the meantime the plans for the new power house which N. Curtis Fletcher, of Boston, is to build are being inspected by local contractors and bids upon the construction of the house have been received.

BALTIMORE, MD.—The Waverly barn of the United Railways & Electric Company was destroyed by fire recently, resulting in the damage and loss of a number of cars. The car barns will not be rebuilt on the old site, it being the intention of the officials of the company to dispose of the property and erect new barns farther north.

DUDLEY, MASS.—Local people are agitating all-night electric light service, and if interest enough is aroused an appropriation will be called for at the annual town meeting.

PITTSFIELD, MASS.—The City Council has adopted an order authorizing the mayor to petition the Legislature for permission to remove overhead wires within half a mile of North and South Streets.

WEST MEDWAY, MASS.—The selectmen have given their final hearing on the petition of the Edison Illuminating Company for location of poles, etc. The number of lights in town has been limited to 200.

WESTBORO, MASS.—The Selectmen have called a special town meeting, to be held at the town hall Wednesday evening, January 24, when the town will be asked to consider the establishment of a municipal lighting plant.

LYNN, MASS.—Plans are under way for the construction of a railway from the line of the Rutland Road to the marble quarries in Danby, recently purchased by the Vermont Marble Company. The company will erect a power station on Mount Tabor to generate power to operate the machinery in the quarries.

NORTH ADAMS, MASS.—A bill has been presented in the House, accompanied by a petition signed by Frank S. Richardson, vice-president and treasurer of the North Adams Gas Light Company, to authorize the company to furnish electricity for light, heat and power in the towns of Munroe, Savoy and Florida.

BOSTON, MASS.—The gas commission has given a hearing on the petition of the Hyde Park Electric Light Company for authority to increase the capital stock $62,500, making the total capital $350,000. E. W. Burdett appeared for the company and explained that the proceeds for the new stock were to be used in construction, additions and in paying the floating indebtedness. Frank B. Rich, chairman of the Board of Selectmen, was present and intimated that he would oppose the petition.

BROCKTON, MASS.—Repairs to the electric lighting plant of the City Hall that are estimated will cost $1,000 will have to be made this year. The committee on City Hall held a meeting last evening. Chief Engineer Al. Leonard came before the committee and urged the necessity of making these repairs this year if the efficiency of the plant is to be maintained. He has recommended these changes for several years without result. The committee was informed that affairs are in a rather serious condition as a result of the neglect of other city governments to make proper repairs and that the engines are in such condition to-day that general repairs must be made on these and on the dynamos.

LAPEER, MICH.—W. E. Brown and Joseph H. Crawford, of Flint, have petitioned for a franchise to furnish light and heat.

LANSING, MICH.—The Piatt Heat & Power Company has secured practically all of the right of way for the Grand Ledge electric railway and announces that the road will be built during the year.

MARION, MICH.—An electric light franchise has been granted to E. S. George, of this place, the franchise stipulating that the plant shall be in operation by July 4. The plant will be run by water power.

GRAND RAPIDS, MICH.—The Grand Rapids & Battle Creek Inland Lakes Traction Company reports that it has the right of way for its proposed line practically all secured, and that the road is reasonably certain to be built during the coming season.

PONTIAC, MICH.—The Clinton River Power Company has been reorganized and development work will be pushed as rapidly as possible. H. von Schon, of Detroit, is consulting engineer for the new company.

MANISTEE, MICH.—Bascom Parker, of Niles, is said to have purchased the gas and electric light plants here and will probably make improvements.

BANCROFT, MICH.—Lloyd Stoddard, representing a Saginaw concern, has asked for an electric lighting franchise at Bancroft, and for a contract to light the village. He offers to light the village until midnight each night for $50 per lamp per year, and furnish incandescent lighting at 12 cents per kw-hour. His company proposes to utilize the power of the Shiwassee River and light Morrice and Perry as well as Bancroft.

FARMINGTON, MINN.—Charles Heckel, of Prescott, Wis., has petitioned for a franchise for an electric light plant here.

REDLAKE FALLS, MINN.—E. L. Healy, of Redlake Falls, is reported interested in the construction of an electric light plant.

WATERVILLE, MINN.—C. H. Birch, George J. Dressel and others are interested in the formation of a company with a capital of $8,000 to construct an electric light plant.

CANNON FALLS, MINN.—The water power plant on Cannon River, plans for which have been pending for some time, will be constructed this year. Power will be transmitted to Northfield and Cannon Falls and possibly to Red Wing. H. von Schon, of Detroit, Mich., is chief and consulting engineer.

BOULDER, MONT.—Edward Kennedy, of Basin, Mont., is interested in the construction of an electric light plant at Boulder.

GREAT FALLS, MONT.—The Rocky Mountain Bell Telephone Company will make improvements in its system here and will install a new switchboard.

BUTTE, MONT.—W. H. Reber has made application for a 40-year electric light franchise for the operation of a lighting system here.

MILAN, MO.—The Milan Telephone Company has been sold to the Bell Telephone Company in consideration of $10,000.

ST. JOSEPH, MO.—The proposition to build a trolley line from Trenton to Chillicothe has been revived and it now looks as if the road would be built. Chicago and New York capital has been interested to the amount of $600,000.

ST. LOUIS, MO.—Eugene C. Slevin, Edward V. P. Schneiderhahn and C. A. Cunningham have applied for a franchise to construct and operate an electric railway from St. Louis to Ferguson and Florissant. The new road will shorten the route from Florissant to St. Louis by about five miles. The promoters agree to begin work within six months from date of acceptance and to have the road completed within two years.

VANDALIA, MO.—The City Council has granted the Vandalia Electric Light Company a 20-year franchise. The rates for lights are practically the same as heretofore, but the provision is made that the lights must be up to the standard all the time or consumers need not pay the rates. The city will pay 75 cents for 16-cp lights and $1.35 for 32-cp lights. Mr. Beshears, who owns the plant, states that he expects to organize a stock company and will equip the plant for both night and day service and furnish power for manufacturing purposes.

PIERCE, NEB.—The Pierce Electric Company is considering the installation of a storage battery. M. J. Henzler is manager of the company.

GRAND ISLAND, NEB.—The City Clerk writes that an election will be held on March 6 to vote on an issue of $35,000 bonds for a municipal electric light plant.

WARREN, N. H.—The Baker's River Telephone Company at its annual meeting voted to increase its capital stock to $3,500 and to begin construction as soon as the ground opens in the spring.

ORANGE, N. J.—Press reports state that bids will be received by the Committee on Street Lights until February 5 for lighting the city for three and five-year terms from December 1 next.

NEWARK, N. J.—Application has been made to the Board of Works by the Coast Line Telephone Company for a franchise empowering the concern to construct a new telephone system in this city. The company asks the right to construct conduits through every important thoroughfare in Newark.

TRENTON, N. J.—At the special meeting of the Board of Freeholders, January 17, a franchise was asked by the Trenton, Ewing & Hamilton Traction Company to lay tracks on several county roads in order to extend the Trenton street railway lines in the direction of Trenton Junction, Hamilton Square and within half a mile of Allentown. The matter was placed in the hands of the Road Committee and will be considered at the February meeting.

MACEDON, N. Y.—It is probable that an election will soon be held to vote on issuing bonds for an electric light plant.

LAKE PLACID, N. Y.—Application has been made to the County Commissioners by the town for permission to build and operate a municipal lighting plant.

BROADALBIN, N. Y.—The State Gas Commission has granted the application of the Broadalbin Electric Light & Power Company to do business and issue $40,000 bonds and $7,500 of stock.

LOCKPORT, N. Y.—The Lockport Gas & Electric Light Company has decided to improve the local street lighting system. Enclosed arc lamps will be installed. O. M. Diall is superintendent of the plant.

SYRACUSE, N. Y.—The Niagara, Lockport & Ontario Power Company is making preparations for the erection of another double line of steel towers paralleling the one which is partially completed between this city and Lockport.

NEW YORK, N. Y.—Cary T. Hutchinson, Chairman of the Commission on Lighting, has recommended to the Board of Estimate that $100,000 be appropriated to carry on the work of subways for electric and other wires in the various boroughs of the city.

SENECA FALLS, N. Y.—The Interurban Gas Company, which supplies gas to Geneva, Seneca Falls and Auburn, is reported to have purchased the plant of the Seneca Edison Company. It is said to be the purpose of the Interurban Company to construct an electric light plant at Geneva, to supply Geneva, Waterloo and Seneca Falls with electricity.

BLACK RIVER, N. Y.—A new hydro-electric plant is to be installed at this place. Mr. J. B. Taylor, the owner of the Watertown Gas Company, is backing the project. There is available about 4,000 hp at low water. The current will be transmitted to Watertown, 7 miles distant, and utilized for a new lighting system and other purposes. The development on the Black River will utilize the entire flow at 20-foot head. Mr. C. C. Burns, of Watertown, is the hydraulic engineer, and Mr. Bert H. Shepard, of Black River, is consulting and electrical engineer.

ROCHESTER, N. Y.—The proposition has been made to the city by local engineers that in its two great trunk sewers Rochester possesses a water power sufficient to develop 500 hp daily at a minimum estimate. These two sewers empty into the river gorge fully 200 feet above the level of the river, and the sewage proper is so diluted by the flow of water and the long course over which it runs that the power-producing properties of the water are little, if any, reduced by its presence. A meeting is to be held to discuss the project and the advisability of installing the necessary plant.

CARRINGTON, N. D.—The citizens have voted to issue $16,000 water and light bonds.

WILLISTON, N. D.—A bond issue of $12,000 is to be voted upon here shortly, for establishing an electric light plant and water-works system.

FOSTORIA, OHIO.—The Toledo, Fostoria & Findlay Railway is planning to make a further extension into Toledo. F. W. Adams is securing the right of way.

STEUBENVILLE, OHIO.—The Steubenville & Pleasant Heights Traction Company has applied for a franchise to enable it to build an extension to La Belle View.

FINDLAY, OHIO.—The Toledo, Bowling Green & Southern Traction Company is preparing to double track a considerable portion of its city system here and make other improvements.

LODI, OHIO.—Col. C. V. Hard, of Wooster, and W. H. Abbott, of Cleveland, were in Lodi recently looking after matters in connection with the Cleveland, Ashland & Mansfield Railway.

CLEVELAND, OHIO.—T. F. Hynes, of Cleveland, is promoting the Sandy Valley Traction Company, which proposes to build a line from Alliance to Canal Dover, touching Oneida, Waynesburg and several other towns.

EAST LIVERPOOL, OHIO.—Arrangements are being made to install a new switchboard in the Bell telephone office soon. This is the third switchboard to be installed and will accommodate from 100 to 150 more subscribers.

CINCINNATI, OHIO.—The Cincinnati, Milford & Loveland Traction Company, which recently extended its line to Blanchester, is now planning a further extension to Wilmington, with Columbus as the ultimate objective point.

SHELBY, OHIO.—J. W. Williams, H. W. Hildebrand, I. E. Will and others, of Shelby, are applying for a franchise for entrance for an electric railway into town. They propose to build from Shelby to Plymouth, a distance of eight miles.

CLEVELAND, OHIO.—The Lake Shore Electric Railway Company has closed a contract for a 2,000-kw Westinghouse-Parsons turbine for its Beach Park power station. About 1,000 hp of boilers and stokers will be contracted for immediately.

CHILLICOTHE, OHIO.—It is announced that G. A. Vaughters has obtained a controlling interest in the Chillicothe Electric Railway, Light & Power Company and will manage the property in the future. Considerable new equipment will be purchased.

LIMA, OHIO.—Bids will be received by the Board of Public Service until February 24 for the installation of a power plant to drive two 18-inch centrifugal pumps and deliver 500,000 gal. from each against a main head of 17 feet and a maximum of 25 feet friction included. For further information address the city engineer.

COLUMBUS, OHIO.—In a recent communication to the Council, George S. Marshall, city solicitor, expressed the belief that commercial lighting by the city is the only solution of the electric light question in Columbus, and asked the Council to petition the Legislature to grant to cities that power. The city now has a splendid municipal plant, with its pole line complete all over the city, and it would be comparatively inexpensive to increase the capacity of the plant to furnish all the people desiring it with electric light and power.

BAKER CITY, ORE.—A representative of the Pacific States Telephone & Telegraph Company has been looking over the ground here with a view to establishing an exchange.

GRANT'S PASS, ORE.—The Condor Water & Power Company has purchased the plant of the Grant's Pass Water, Light & Power Company and will make improvements to same.

COTTAGE GROVE, ORE.—A company has been organized for the purpose of constructing a telephone line to Bohemia. A capital of $1,500 has been subscribed up to the present time. Another meeting will be held February 5 for a further discussion of plans.

GRANITE, ORE.—Anthony Maher, of Sumpter, Ore., and W. E. Hurd, are promoting a project for the building of an electric railway from Sumpter to Granite and on to the Greenhorns, the Red Boy and Alamo, the main object being to furnish transportation to the smelter at Sumpter or to outside points.

PORTLAND, ORE.—The syndicate which has been formed by Moffat & White to build and operate an electric railroad between Portland and Salem, Ore., has been closed. This new road will be about fifty miles long and the construction work which has already commenced has progressed as far as Chenawa. The road will be laid with 70-lb. steel rails,

and the construction throughout will be of the most substantial character. The work is in charge entirely of Barstow & Chambers, engineers of New York and Portland, of which Mr. W. S. Barstow, president of the New York Electrical Society, is at the head.

PORTLAND, ORE.—Two new companies have applied for franchises to operate in the city—the Cascade Power Company and the Banfield-Veysey Fuel Company. The Cascade Company proposes to establish a plant for lighting and power purposes which would cost about $500,000, and said that $250,000 additional would be expended by the company in construction work. M. C. Banfield, of the Banfield-Veysey Fuel Company, states that his company intends to put in a steam-heating and cold storage plant and would also furnish electric light and power. The proposed plant will cost approximately $750,000, the money to be furnished by local capital. It is desired to install the plant this coming summer if the franchise is granted in time.

WARREN, PA.—The Corry & Columbus Street Railway Company is preparing to begin the construction of its proposed line between Corry and Columbus in the spring. C. P. North, of Warren, is president of the company.

ALLENTOWN, PA.—Plans are under way for the construction of a new trolley line to connect Bethlehem, Catasauqua, Alliance and Nazareth with Allentown. The proposed line will be under the control of the East Pennsylvania Traction Company.

PITTSBURG, PA.—The Corporation Committee of the Council on January 19 recommended the passage of the ordinance granting the Southside Electric Manufacturing Company permission to extend its lines and conduits to all parts of the Southside.

OIL CITY, PA.—Bids will be received until February 20 by the Commissioners of Water and Lighting (A. M. Breckenridge, clerk) for lighting the streets, city buildings and hose houses with electricity for periods of 5 and 10 years, commencing July 1, 1906. .

CARLISLE, PA.—The Cumberland Valley Railway Company has decided to operate the Waynesboro Branch and the South Pennsylvania road by electricity. An electric power plant will be erected in Chambersburg which will cost, together with the most modern equipment, $135,000.

ANDERSON, S. C.—The Savannah River Power Company has been organized to develop Gregg and Cherokee Shoals on Savannah River. Partial development will be made at first at a cost of about $300,000. J. E. Sirrine, of Greenville, is the engineer.

PIERRE, S. D.—The Sioux Falls Interurban Electric Railway Company announces that it will build a line in the spring in a southwestern direction to Parker.

KNOXVILLE, TENN.—The Knoxville & Maryville Railroad has asked for a franchise over certain streets of this city.

DAYTON, TENN.—The Rhea County Electric Light Company, of which W. J. Holman is superintendent, contemplates replacing its engine and generator with machines of larger size.

NASHVILLE, TENN.—It is stated that the Nashville Home Telephone Company will begin the installation of a telephone system in Nashville during the present year. The company expects to have 6,000 telephones installed within two years.

DALLAS, TEX.—Announcement is made that the Dallas Consolidated Electric Street Railway Company will spend more than $200,000 in improvements. Of this sum $80,000 is to be used for the increase and improvement of the rolling stock, while the remainder, $120,000, will be expended in trackage and general improvements.

BEAUMONT, TEX.—Extensive improvements are to be made in the light plant of this city. The company has awarded contracts for new and improved machinery in the power house and light plant sufficient to provide for increased capacity to supply 6,000 additional lights, while the present light service will be incidentally bettered and improved. The improvements will cost over $50,000.

GAINESVILLE, TEX.—The annual meeting of the Gainesville Electric Railway & Light Company has just been held and the followinng named officers elected: Edward J. O'Bierne, of Atlanta, Ga., president; Chas. A. Ziker, of San Antonio, Tex., vice-president; W. H. O'Bierne, of Gainesville, secretary and manager; W. L. Greenhill, of Gainesville, treasurer. The company desires to put the plant in better condition and expects to take up the railway project in due season.

MOAB, UTAH.—Charles A. Robertson is reported to be preparing to establish an electric light and power plant at this place..

NORTHFIELD, VT.—The village trustees are preparing a report as to the cost of building and equipping a new electric light plant and will call a special meeting soon.

COLONIAL BEACH, VA.—The Town Council has granted Capt. E. S. Randall a franchise for lighting the town by electricity and for the establishment of a telephone service. The electric light plant now used to light the hotel at the Beach will be enlarged.

OLYMPIA, WASH.—John L. Murray is reported to have petitioned the Council for a franchise for an electric light system.

KENNEWICK, WASH.—G. E. Wood, of Genesee, Idaho, has secured a franchise and will establish water works and an electric light plant here.

TEKOA, WASH.—F. J. and E. W. Mahoney have petitioned the City Council for a franchise to install and operate an electric light, heat and power plant.

CENTRALIA, WASH.—The Centralia-Chehalis Electric Railway franchise has passed the Council. It provides for a railway to be built between the two cities.

DAVENPORT, WASH.—The Spokane & Big Bend Electric Railway has asked for a franchise through Lincoln County and the matter will be taken up by the County Commissioners on February 23. Davenport has also been asked for a 10-year franchise through its streets.

BELLINGHAM, WASH.—The County Commissioners are reported to have granted to the Whatcom County Railway & Light Company, of which Francis E. Frothingham, of Bellingham, is manager, a franchise to construct lines and conduits over the road connecting this city with the Nooksack Falls power plant, for the transmission of electric power to Bellingham.

OLYMPIA, WASH.—John L. Murray has asked for a franchise for a steam heat and electric light plant. It is proposed to erect a large plant on the water front in the mill district at the head of the bay, which will furnish steam for heating purposes to buildings in the business section and electric current for power and lighting purposes in perhaps a more extended territory. One of the interesting features of the plan is to utilize waste material from several of the big mills on the water front for fuel. The cost of the plant is estimated at $10,000.

VANCOUVER, WASH.—Manager J. R. Harvey, of the Vancouver Electric Light & Power Company, has announced that the entire stock of the corporation has passed into the hands of H. W. Goode, of Portland While the price paid has not been made public, it is understood that the amount received was $200,000. It is said that the purchase was made by Mr. Goode on behalf of himself and Eastern capitalists desirous of entering the lighting field of the Northwest. Mr. Harvey states that improvements totaling $50,000 are planned for this year.

BELOIT, WIS.—W. H. Wheeler is interested in the organization of a company to build a street railway in Beloit.

SHEBOYGAN, WIS.—It is stated that the Citizens' Telephone Company will expend $30,000 in installing automatic telephones.

OCONTO, WIS.—Bids will be received at the office of the city clerk until February 6 for furnishing the city for a period of three years 50, more or less, arc lamps of 2,000 cp each, to be operated all night on a moonlight schedule. Joseph Pocquette, Chairman Electric Light Commission.

OLDS, CAN.—The town is trying to secure an electric lighting plant. Address the mayor.

CALGARY, CAN.—The City Council is considering plans for an electric lighting plant, to cost $20,000.

PRINCETON, CAN.—F. E. Voight has decided to erect an electric lighting plant on the Simalkameen River.

CHILLIWAC, B. C., CAN.—A. M. L. Hawkes, of this town, has been enngaged to design the new plant for the Chilliwac Light & Power Company.

PRINCE ALBERT, CAN.—Willie Chipman, C. E., Toronto, Ont., is preparing plans to develop the water power 12 miles north of here to supply the town with light and power. Addres Mayor Cowan.

CALGARY, CAN.—The Canadian Pacific Railroad Company will develop the water power at Kananaskis Falls and transmit it to this city, a distance of 63 miles, for light, heat and power purposes. Address Supt. Dennis, Calgary.

WINNIPEG, MAN.—Bids will be received by Alderman J. C. Gibson, chairman of the Fire, Water and Light Committee, until February 12 for 100 to 200 series alternating-current arc lamps, 100 to 200 cutouts, two or four constant-current transformers, and two 500-hp electric generators.

WINNIPEG, MAN.—The Winnipeg, Selkirk & Lake Winnipeg Electric Railway has broken the negotiations for the sale of its property to the Winnipeg Street Railway Company and applied to the Winnipeg City Council for permission to lay rails on the city streets and bring its lines into the heart of the city.

ST. JOHN, N. B.—The Council has adopted a resolution authorizing the Safety Board to employ an electrical engineer to estimate the cost, etc., of establishing an electric light plant.

ST. JOHN, N. B.—At a meeting of the town authorities recently, the provincial engineer reported in favor of the plans as submitted by the Grand Falls Water Power Company for the development of water power at Grand Falls.

BOBCAYGEON, ONT.—Charles E. Stewart, village clerk, writes that the proposed municipal electric light and power plant will cost from $10,000 to $15,000. Bids will be called for in a few months.

WOODSTOCK, ONT.—Bids will be received until January 30 by John Morrison, City Clerk, for $50,000 bonds, the proceeds of which will be expended in improving the water works and electric light system.

GUELPH, ONT.—The directors of the Guelph Street Railway are considering the extension of their road to Puslinch Lake and Hespeler, a distance of about nine miles. The extension will probably cost $150,000.

PICTON, ONT.—R. A. Norman, city clerk, reports that bonds to the amount of $10,000 will be sold, to be used to install a new electric street lighting plant and to improve and extend the present commercial and residential system which is owned by the city.

New Incorporations.

SACRAMENTO, CAL.—Articles of incorporation of the Sacramento & Lake Tahoe Railway Company have been filed with the County Clerk. The purpose of the company is to construct and operate a railway from Sacramento to Auburn, a distance of 40 miles. The capital stock of the company is $7,500,000.

LOS ANGELES, CAL.—The Mt. Wilson Railway Company, of Pasadena, has been incorporated with a capital stock of $500,000. The directors are William R. Staats, James H. Holmes and W. S. Wright. This company will assume the obligations of the Pasadena & Mt. Wilson Toll Road Company.

JOILET, ILL.—Articles of incorporation of the Joliet & Southern Traction Company have been filed. The capital stock is $10,000 and the incorporators are H. A. Fisher, E. F. Fisher and others.

INDIANAPOLIS, IND.—Capitalists of this city and Chicago, who plan to build an electric railway between this city and Louisville, have incorporated the Indianapolis & Louisville Traction Company, capitalized at $3,000,000. The incorporators are John E. Greeley, Robert Candee and B. F. Rice.

CRAWFORDSVILLE, IND.—The Crawfordsville & Northwestern Traction Company has filed articles of incorporation with the Secretary of State. The capital stock of the company is $100,000. The proposed line is to start at Crawfordsville and pass through Wesley, Waynestown, New Richmond, Wingate, Attica, Hillsboro, Melott, Aylesworth, Stone Bluff, Newton, Williamsport, Kramer, Carbondale, Judyville and Pener. Spencer J. Hunt, A. L. Mason and J. F. McFarland are the incorporators.

NEW ORLEANS, LA.—The Algiers Railway & Lighting Company, with a capital of $360,000, has been incorporated and will absorb the Algiers Water Works & Electric Company, of Algiers, La.

BEATRICE, NEB.—The New Home Telephone Company, with a capital of $20,000, has been incorporated by F. H. Woods, of Lincoln, and others.

OREGON CITY, ORE.—Articles of incorporation have been filed by the Oregon City & Farmers' Independent Telephone Company, with a capital of $5,000.

PORTLAND, ORE.—The Oregon Independent Telephone Association has been organized in Portland, with a charter membership comprising a large number of the independent companies of the State. The officers are F. H. Stowe, president; S. G. Hughes, vice-president; P. L. Brown, secretary and treasurer.

LEBANON, PA.—The Myerstown and South Lebanon electric companies have filed articles of incorporation, the capital stock of each company being $5,000. The directors of both concerns are Dr. Walter Rigg, Milton Miller and Harry H. Reigel.

HARRISBURG, PA.—Charters were issued at the State Department last week to six Western Pennsylvania electric railway companies, all having the same incorporators: Shenango-Midland Street Railway Company, 7 miles of road in the vicinity of Sharon, $42,000; Northern Middlesex Street Railway Company, to build 4 miles in the vicinity of Wheatland, $24,000; Shenango Northern Street Railway Company, to build 4 miles of line in the vicinity of Sharon and Hickory township, Mercer county, capital $24,000; Central New Castle Street Railway Company, to build one mile of line in New Castle, capital $6,000; Shenango Southern Street Railway Company, to build 3 miles of line in the vicinity of Wheatland, capital $18,000. The incorporators are: Edward Ripley, C. G. Glatson, W. H. Waugh, J. D. White and E. A. Henry.

ETTRICK, WIS.—The Ettrick Telephone Company has been incorporated by K. A. Knutson, and others, with a capital stock of $8,000.

HALE, WIS.—Pleasant Valley Telephone Company has been incorporated, with a capital stock of $4,000, by Leo L. Swain and five others.

New Industrial Companies.

THE NATIONAL ENGINEERING COMPANY, successor to McGrew & Bruning, consulting and construction engineers, has been incorporated at Columbus, Ohio.

THE ENGINEERING, LIGHT & ILLUMINATION COMPANY, of New York City, having a capital stock of $20,000, has been incorporated. The directors are A. A. Ernst, Edgar Beekman and C. C. Beekman.

THE RUSSELL ELECTRIC COMPANY, of Danbury, Conn., has been formed; capital stock, $25,000; incorporators, William Edwin Russell, and William Earl Russell, of Danbury, and Charles B. Russell, of Worcester, Mass.

GAIL-WEBB MANUFACTURING COMPANY, Buffalo, N. Y., has filed articles of incorporation in which the directors are named as follows: H. M. Gail, H. M. Smith and O. M. Gail. The company is capitalized at $25,000 and will manufacture telephone apparatus.

THE ELECTRIC MACHINE MANUFACTURING COMPANY, New York City, has been incorporated. The company is capitalized at $25,000, and the following gentlemen are named as directors: F. G. Hall, Jr., of Brooklyn; W. P. Passenger, of New York, and Thomas Aldcorn, Union Hill, N. J.

VICTOR ELECTRIC MANUFACTURING COMPANY, of Brooklyn, N. Y., has been incorporated, with the following directors: J. B. d'Homergue, L. P. Baldwin, Harry Hertzberg, William P. Snyder and Harry F. Ashbury. The company has a capital stock of $100,000, and will manufacture electric meters, etc.

THE HARTFORD LIGHT & EQUIPMENT COMPANY, of Hartford, Conn., has filed a certificate of incorporation. It has a capital stock of $75,000, and it proposes to lease and rent prismatic hoods for intensifying and diffusing electric light. The company has elected these officers: President, James H. Bolton, of Hartford; vice-president, Henry Schoenfield, of Congers, N. Y., and secretary and treasurer, William S. Davis, of Hartford.

Legal.

CHICAGO TRACTION LITIGATION.—At Chicago on January 17, suits were filed by the city in the Circuit Court against the Union Traction Company for $1,500,000 and the Chicago City Railway Company for $500,000 for violations of the good service ordinances. The suits were filed by Julius G. Grossberg, traction ordinance counsel for the city, and were intended to forestall any possible injunctional proceedings which the companies might bring against the city.

ROOF TELEPHONE WIRES.—The Appellate Division of the New York Supreme Court has affirmed a judgment of the lower court in the case of Ratje Bunke against the New York Telephone Company. The plaintiff sued to recover $200 for the use of the roof of his house at 327 Pleasant Avenue for telephone wires. Justice Laughlin writes the opinion of the Appellate Division. He says: "The defendant has no right to invade private premises and attach its wires to roofs or chimneys without a license from the owner, and it has no right to maintain them after a change in ownership without further license. It is difficult for a plaintiff in such a case to prove the damages which he is entitled to recover. In the case at the bar we are of the opinion that he has proved his case by the best evidence obtainable."

BARRING UNION MEN.—The Appellate Division of the New York Court has handed down an opinion in the case of Harry Marcus, who was charged with and convicted of coercing one Hyman Sheinbaum to enter into a written agreement with the H. Marcus Shirt Company not to become a member of any labor organization as a condition of obtaining employment with that concern. The Appellate Division reverses the judgment of conviction and orders the discharge of the defendant. Justice Laughlin writes the opinion, in which Presiding Justice O'Brien and Justices Patterson and Ingraham concur, Justice McLaughlin concurring in the result. The court holds that Section 171A of the Penal Code, which forbids the making of contracts of the kind described, is unconstitutional. Justice Laughlin says: "It has always been supposed, and the decisions so holding are numerous, that an employer, so long as the contract does not affect the public health, morals or welfare, is at liberty to employ or discharge whomsoever he pleases, and to refuse to employ any person without becoming answerable therefor except for a breach of contract for an unjustifiable discharge of an employe. The contracts at which the provision of the Penal Code in question is aimed, it is true, do discriminate against labor unions; but that is in the lawful exercise of the employer's right to employ whomsoever he pleases, and it is not competent for the Legislature to make it a crime for him to decide the question upon what considerations of race, or of religion, or of affiliations of the individual with civic organizations unless, of course, he makes a contract contrary to public policy and affecting the State itself, or, for instance, imposing as a condition that the employe shall not join the National Guard, the maintenance of which is essential to the peace and safety of the property of the State."

CONSTRUCTION OF POWER PLANTS.—The Appellate Division of the New York Supreme Court has reversed a judgment recovered by the National Contracting Company against the Hudson River Water Power Company for more than $500,000. The action involved altogether claims aggregating more than $1,000,000, including the counter-claim of the Hudson River Water Power Company against the National Contracting Company. The contracting company was constructing in 1900 a huge masonry dam across the Hudson at Spier Falls for the power company, under a contract which permitted the owner to change the plan, dimensions and material with the approval of William Barclay Parsons. It was believed it might become necessary to substitute a core wall with earth re-enforcements for solid masonry and the Hudson River Water Power Company gave notice to the contracting company that such a change might be required, but requested the contracting company to proceed with the work until the time came when the necessity for such a change could be determined. As the work proceeded the contracting company treated this notice as a breach of contract and sued for $500,000. The case was heard before Henry W. Bookstaver, as referee, whose report favored the plaintiffs. The appellate division, in an opinion delivered by Justice Ingraham, holds that there was no breach of contract and that the contract permitted changes in material of construction. He also holds that the decision upon the demurrer is a conclusive adjudication against the plaintiff's alleged cause of action, and that no breach of the contract on the part of the defendant existed which justified the plaintiff's refusal to perform or entitled the plaintiff to any recovery. The provisions of this contract did not justify the position taken by the plaintiff. The contract, under the provisions above referred to and others, contemplates a change in both the plans and methods of doing the work described. It was recognized that work of this magnitude could not be settled in all its details in advance of the conditions that were found to exist, and thus the necessity for the change of plans was recognized and provided for.

Personal.

MR. E. A. TURPIN, chief clerk to General Manager A. L. Drum, of the Chicago & Milwaukee Electric Railroad, has been appointed purchasing agent of the company.

MR. FRED'K R. SLATER, electrical engineer, announces that he has opened an office at 100 Broadway, New York City, for the practice of his profession.

MR. WELLS M. IRWIN has been elected president of the Board of Directors of the Keokuk & Hamilton Water Power Company, to succeed his late brother, the Hon. John N. Irwin.

PROF. ELIHU THOMSON gave a lecture last week before the Worcester, Mass., Board of Trade, on the power possibilities of the future. There was a large and enthusiastic audience.

MR. J. E. HODGSON, formerly of Philadelphia, has been given entire charge of the electrical department of the Fulton County Gas & Electric Company, of Gloversville, N. Y., which operates three or four of the companies in that vicinity.

MR. H. S. DURANT announces that he has recently taken a partnership interest in the firm of Geo. W. Conover & Co., of Chicago, purchasing and forwarding agents for independent telephone companies. Mr. Durant has been identified with the Automatic Electric Company's sales department for the past three years.

MR. FRANK CAUM, who in June of last year succeeded Mr. Norman McD. Crawford as general manager of the Hartford lines of the Consolidated Railway Company, operating the electric railway properties owned by the New York, New Haven & Hartford Railroad Company, has resigned to become the general manager of the Scranton (Pa.) Street Railway Company.

MR. E. G. WINSTON has accepted a position as engineer with the O. C. Irwin & Co., Crawfordsville, Ind., and will have charge of the design and manufacture of its entire product. Mr. Winston has had a number of years' experience with the leading electric companies and is well qualified for his new duties. The company manufactures alternating-curent generators and transformers.

MR. CUTHBERT SCHAEFER, who was for ten years in the contracting business in New Orleans, and who for the past two years has been connected with the B. F. Sturtevant Company, of Boston, in its Chicago office, enters the employ of Evans, Almirall & Co. in their Chicago office as assistant western manager. Mr. Schaefer is a graduate of Cornell University in the class of 1904.

MR. T. L. JOHNSON.—Mayor Tom L. Johnson, of Cleveland, says he has no intention of becoming a new Yerkes in Philadelphia. He is to talk over the Philadelphia street railway situation with the Philadelphia trades league committee and give them the benefit of his experience as a successful promoter and manager of street railways.

MR. HENRY T. SCOTT has been elected to succeed the late John I. Sabin as president of the Pacific States Telephone & Telegraph Company, with headquarters in San Francisco. At the conclusion of the directors' meeting, Frederick P. Fish, president of the American Telephone and Telegraph Company, entertained the directors and President Scott at a luncheon given at the St. Francis, in San Francisco.

MR. PUTNAM A. BATES will lecture before the Electrical Engineering Society of Columbia University, New York City, on February 7, at 8 p. m., on "Isolated Plant Engineering." The lecture will be given in room 301, Engineering Building. An invitation to attend is extended to those interested. Mr. Bates has lately given considerable attention to this class of work, and is the consulting engineer for the new Engineers' Club building on Bryant Park.

MR. RUSH B. HOLBROOK, formerly chief engineer of the Cedar Rapids and Marion City Railway Company and later chief engineer of the American Cereal Company, has recently taken up his residence in Chicago, where he will engage in business for himself as industrial engineer, taking up especially boiler room economies, smoke abatement and coal performances. Mr. Holbrook's long experience with steam plants of all kinds and sizes fits him unusually well for this work.

MR. C. T. MORDOCK, of Terre Haute, Ind., has been appointed by President Blood to report to the twenty-ninth convention of the National Electric Light Association, to be held in June next, on "Methods of Theft of Current." Past President Ernest H. Davis will make a new compilaton of the laws of the different states governing theft of current, bringing same to date. This is one of the most important subjects with which central stations have to deal, and the report will be very valuable.

MR. J. R. DAVIS, late technical manager of the Midland Electric Company of New York, and Mr. A. J. Alexander's partner will very shortly visit the United States, with a view to purchase suitable machinery for elevators to be constructed at 38 grain receiving stations in the southern Argentine along the Great Southern Railway of the Province of Buenos Ayres. Mr. Alexander expects part of the elevator scheme will be completed for the wheat season of 1906-07 and the remainder in the following year. The capital will probably be subscribed for in England.

MR. BENJAMIN KAUFFMAN, who has for the past year been assistant western manager for Evans, Almirall & Co., in their Chicago office, will become on Feb. 1 western manager for that company. Mr. Kauffman is well known in the heating business, having been for some years connected with the Paul System Company, and afterwards with Thomas & Smith, of Chicago, and the Western Kieley Steam Specialty Company. Mr. Kauffman has been assistant manager for Evans, Almirall & Co. for the past year. He is a graduate of Washington University of St. Louis, Mo.

MR. H. E. ANDREWS takes the controller this week for the New York Central trolley system, as already announced. Mr. W. K. Vanderbilt, Jr., who has been in charge of the recently acquired electric traction properties of the New York Central Railroad, will sail for Europe this week for a long vacation. Mr. Horace E. Andrews, formerly president of the Cleveland Electric Railway, has been put in charge of all the Central's traction properties, with headquarters at the Grand Central Station. He is president of the Mohawk Valley Company, which is the holding company for the Central's traction lines.

MR. JOSEPH P. DEVINE, Buffalo, N. Y., the well-known manufacturer of vacuum drying and impregnating apparatus under the Passburg patents, announces that this business will be carried on in the future by the J. P. Devine Company, in which the Emil Passburg Company, of Germany, is interested. In fact the new company is really the American branch of the parent company. Mr. W. Strohn, who has been closely identified with the Passburg Company for 20 years, comes to this country as vice-president of the J. P. Devine Company, and the latter will have the benefit of his vast experience in manufacturing and installing this kind of apparatus. Mr. Devine is president of the new company, and the offices remain in the Mooney-Brisbane Building.

MR. T. A. EDISON made one of his rare visits to New York last week, one of the attractions being the automobile shows, where he spent several hours. He also gave a sitting to the sculptor, Mr. James Earle Fraser, for the Edison medal of the American Institute of Electrical Engineers—the work on which is now nearly finished. Mr. Edison is deeply interested in the United Engineering Building, and made a visit to the site in order to see how that great enterprise is advancing. He was very much pleased to find steel and stone several stories up in the air. Mr. Edison is a contributor of $5,000 to the Institute Land and Building Fund, which is being raised to pay for the Institute's portion of the land on which the $1,000,000 building given by Mr. Carnegie is being erected.

MR. K. L. MARTIN.—Mr. Kingsley L. Martin, who has been assistant engineer in charge of the Williamsburg Bridge, has been made engineer in charge of both bridges. Archibald McLean, at present assistant engineer in charge of the Brooklyn Bridge, is placed under the direction of Mr. Martin. Olaf M. Kelly has been designated as assistant engineer in charge of the Williamsburg Bridge, and also acts under the direction of Mr. Martin. Mr. Martin, who thus receives complete charge of both brdges, is a son of C. C. Martin, who used to be Chief Engineer and Superintendent of the Brooklyn Bridge. He is 37 years old, and has been connected with the city bridges since 1892, during which time he has had a great deal to do with the electrical questions and problems arising in connection with the bridges.

DR. ROBERT ABBE, a well-known physician of New York City, reporting his experiments with radium, states that it is an effective cure for gout, but does not touch deep-seated growths like cancer. "My idea is that growths or sores of the skin are evidences of balking nature. That is to say, a part of the skin gets tired and refuses to work. It is a good deal like a recreant citizen, who refuses to obey the laws. He's tired of them. Sometimes by giving these persons a little moral support we can cure them. And so it seems to me it is in these physical ailments of the skin. Radium in a great measure seems to supply the deficiency. It gives a tonic to the tired spots. It pleases me to think that along these lines we may perhaps discover a cure for cancer. The germ of the disease has not been found—not even though 10,000 eyes are daily glued to miscroscopes to find it. It may be that cancer means merely nature balking, tired out in various spots of the body."

MR. FRANK N. JEWETT will on February 1 become district representative, with offices in the Marquette Building, Chicago, for the Wagner Electric Manufacturing Company, of St. Louis. Mr. Geo. C. Foster, who has formerly represented the company in Chicago, together with the Allis-Chalmers Company's interests, will hereafter devote all his time to the Allis-Chalmers Company. Mr. Jewett graduated from Cornell in 1893, and after leaving the University was for three years connected with the sales department of the Payne Engine Company, of Elmira, New York. For the past ten years Mr. Jewett has been connected with Evans, Almirall & Co., of New York City, engineers and contractors for their system of heating, which has been largely used for central station heating systems. For six years Mr. Jewett has been western manager and engineer in charge of that company's Chicago offices in the Monadnock Building. Mr. Jewett is also interested in central station properties, being vice-president of the Albert Lea (Minn.) Light & Power Company.

TELEPHONE PERSONNEL.—At a dinner of the New York Telephone Company last week, Mr. U. N. Bethell announced that on March 1, after a continuous service of thirteen years as general manager of the company, he will retire from his office as general manager of the company and assume the duties of First Vice-President and also as President of the New York and New Jersey Telephone Company and several other companies, all operating in the territory between the St. Lawrence and the Potomac. Among other changes announced by Mr. Bethell, introduced for the purpose of the improvement of the service and creating harmony between the operating companies of New York and vicinity,

was that there will be one operating department for the New York and the New York and New Jersey Companies. J. C. Reilly, present manager of the New York and New Jersey Company, will be promoted to Vice-President of that company; J. J. Carty, chief engineer of the New York Company, will become chief engineer of both companies. Supt. H. F. Thurber, of the New York Company, will become the general manager of both companies. Theodore Spencer will become Vice-President of the Bell Company of Philadelphia, F. H. Bethell will become Vice-President of the Chesapeake and Potomac, H. F. Stevens will become Vice-President of the Central New York, and H. E. Hawley will become Vice-President of the Hudson River Company.

Trade Publications.

STEAM ENGINES AND BOILERS.—The Trump Manufacturing Company, Springfield, Ohio, has issued an illustrated catalogue dealing with self-contained side-crank steam engines, and steel boilers of the upright and horizontal stationary and semi-portable types.

STAMP MILLS FOR MINES.—Bulletin No. 1408 of the Allis-Chalmers Company, Milwaukee, Wis., gives a complete description of the Tremain steam stamp mill which has been designed to meet the demands for a simple mill for use on mining properties in the first stages of development.

VARIABLE SPEED.—Booklet 39, issued by the Northern Electrical Manufacturing Company, Madison, Wis., shows some motor drives embodying the well-known Northern variable speed motors which respond to the motor controller with a minimum effort of the machine hand, and secure promptly the graduation of motor speed suited to the work or to the man's own degree of dexterity.

ELECTRIC MINING MACHINERY.—The Jeffrey Manufacturing Company, Columbus, Ohio, has distributed among its friends copies of a well-designed calendar for the present year. Views are given of an electrically driven chain coal cutter and an electric mine locomotive with a string of mine cars just leaving the pit mouth. Surrounding these views are inscribed the words "The Jeffrey cuts the World's coal, and the Jeffrey locomotives haul it."

BOILER-TUBE CLEANERS.—The Lagonda Manufacturing Company, Springfield, Ohio, has just issued a handsomely illustrated catalogue of 36 pages which discusses tube cutters, damper regulators, reseating machines, as well as boiler-tube cleaners. The cleaners are of both the turbine-driven and manually-operated types. These are sold, rented or used by the company in cleaning boilers by contract, just as the customer may prefer.

CORLISS ENGINES.—Bulletin No. 1501 of the Allis-Chalmers Company, Milwaukee, Wis., gives a complete description of Reliance Corliss engines of the belted type, which have been designed to meet the demand for more concentrated power, as the available space has yearly become more expensive. The new design embodies somewhat higher rotative and piston speeds than in the other types, and has, therefore, made necessary a thorough reconsideration of the details entering into the engine as a whole. Each part of the engine is well illustrated in the bulletin.

VARNISHED CAMBRIC CABLES.—The General Electric Company has issued publication No. 1,050, dealing with varnished cambric cables. The construction of the cables is as follows: Specially prepared cotton fabric is coated on both sides with multiple films of insulating varnish. The coated cloth is cut into strips and applied to the copper core with films of special non-drying viscous and adhesive compound between the copper and the taping to prevent any possible action of varnished films on the copper. The result is a flexible and homogeneous insulating wall of great dielectric strength. This insulation, unlike paper, does not absorb moisture and can be used for interior wiring without lead. It is, therefore, unnecessary to seal the ends. It is stated that leaded varnished cambric cable installed in 1898 on 11,000-volt circuits in connection with overhead transmission lines, exposed to lightning discharge, is still in use without failure or deterioration.

DIRECT-CURRENT MOTORS.—The Sprague Electric Company, 527 West 34th Street, New York, has issued bulletin No. 224, dealing with type D direct-current motors of the shunt, series and compound-wound types, designed for 115, 230 and 500-volt circuits. The motor frame consists of a cylindrical magnet yoke, to the inner side of which are bolted the poles each of which supports a field coil. The poles are built of laminated steel punchings, with projecting pole horns for spreading the magnetic flux, and for retaining the field coils. Each pole being bolted to the inner surface of the yoke, a pole with its field coil can easily be removed without disturbing the yoke or the armature. As showing the care taken in insulating the machine, it is worthy of note that the completed armatures are dipped, while hot, in an insulating and moisture-proof compound and then thoroughly baked, which treatment renders the winding impervious to moisture and so cements it in place that destruction of the insulation by vibration is practically impossible.

STATIONARY TRANSFORMERS.—The Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., has placed upon the market a line of core-type transformers as an addition to its familiar lines of shell-type transformers. The high and low-tension coils are wound separately, allowing inspection of all finished parts before assembling. The low-tension winding is composed of one coil per leg, each coil having two sections. These sections are connected so that the inner section of one leg is in series with the outer section of the other leg. This arrangement insures an equal loading of each primary coil irrespective of the loading of the secondary. A balanced voltage is thus maintained on the two sides of a three-wire distributing system. The high-tension winding is divided into two coils per leg to reduce the voltage. Among the advantages of the core-type construction are noted the elimination of sharp bends, which are harmful to insulating material, the circular coils being effectively and economically insulated. These transformers are described at great length in bulletin No. 1126, which has just been issued.

IN A SOUVENIR PROGRAMME.—In the "souvenir" programme, issued for the opening week of the new Majestic Theatre in Chicago, appears the following item: "The electric light and power equipment in the Majestic Theatre Building is one of the best and most modern private plants of its kind in the city. It was built and installed by the Allis-Chalmers Company, of Milwaukee, and consists of three generating units composed of Reynolds-Corliss engines, of the Reliance type, direct connected to Bullock direct-current generators. Two of the engines are 20 in. x 26 in., producing 300 hp each; the third is 16 in. x 30 in. and of 150 hp. The two larger engines are each connected to a Bullock direct-current generator of 200-kw capacity, while the smaller is coupled with a 100-kw generator of the same make. There are two compensating sets, each consisting of a Bullock 45-kw generator and a 15-kw machine. This plant produces a 220-volt power current and a 110-volt lighting current, distributed by the three-wire system through a seven-panel switchboard. The power is used for running the elevators, scene-shifting machinery, compressed air plant, ventilating plant, etc., and furnishes the lighting current for all the building and the theatre illumination."

News of the Trade.

THE MACALLEN COMPANY, of 338 Congress Street, Boston, manufacturer of line material, has changed its name from W. T. C. Macallen Company to that given above.

THE STANLEY-G. I. ELECTRIC MFG. CO. has established an office at No. 505 Postal Telegraph Building, Kansas City, Mo., for the purpose of more conveniently and more quickly taking care of its many customers in the State of Kansas.

THE BANNER ELECTRIC COMPANY, of Youngstown, Ohio, has recently moved into its new building, where it has every facility for handling its growing business. The company's new home is a three-story brick structure and contains 32,000 square feet of floor space. The capacity of the new plant is said to be 5,000 lamps a day.

THE W. & S. MFG. CO. is the name of the new company that succeeds to the business of Wilson & Smith, 9 Hunt St., Worcester, Mass. This company has for a great many years been engaged in metal punching and die making and similar work. A special product of the old firm has been armature discs. The new company continues the business of the old without any essential change.

CATALOGUES WANTED.—The Black & Phipps Electrical Company, contractor and specialist, of Brantford, Ont., Canada, has entered the electrical fixture and supply business and has opened show rooms and office at 215 Market Street, that city. It would like to receive catalogues and price lists of general electrical supplies from the manufacturers, with price lists, and other information.

THE ALLIS-CHALMERS COMPANY reports the receipt of several contracts for turbine generating units of 500-kw capacity, among them one from the city of Jacksonville, Fla., which is installing new equipment consisting of two steam turbines coupled to 500-kw three-phase, 60-cycle, 2,300-volt generators. These units will be the first steam turbines of Allis-Chalmers manufacture to be installed in the South.

ELECTRIC MFG. & EQUIPMENT COMPANY.—The name of the Wotton Electric & Manufacturing Company, of Atlanta, Ga., has been changed to Electric Manufacturing & Equipment Company, and the capital stock has been increased from $65,000 to $167,000 paid up. Mr. F. M. Laxton, the general manager, informs us that they are adding new buildings, new automatic machinery and thorough equipment in every respect, and have gone extensively into the manufacture of Wotton telephones, switchboards, and loud-ringing extension gongs. The growth of their switchboard business is due to the introduction of a new interchangeable type, available for both magneto and common battery service.

COAL & IRON BANK.—The Coal & Iron National Bank, Liberty & West Streets, New York City, is reaching a large and growing clientele in the electrical and mechanical field at the centre of which it does business, while in the railroad field it has many affiliations. Mr. E. E. Loomis, vice-president of the D., L. & W. R. R., has become a member of the board of directors and through this latest accession to the board it will now be associated with the following railroads: the B. & O.; C. R. R. of N. J.; Lehigh Valley; Reading; D., L. & W. This is in addition to a diversity of commercial and banking interests, representing an aggregation which can hardly be equaled by the board of directors of any other kindred institution. The Bank is therefore in a position to offer to houses in the electrical world the facilities of an institution which is safe, sound and conservative.

Weekly Record of Electrical Patents.

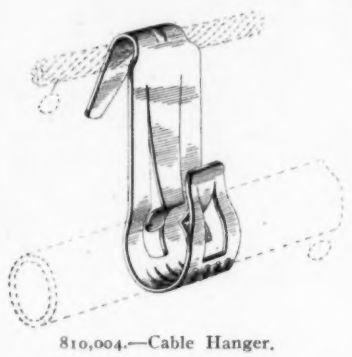
UNITED STATES PATENTS ISSUED JAN. 16, 1906.

[Conducted by Rosenbaum & Stockbridge, Patent Attys., 140 Nassau St.]

809,939. INTERCOMMUNICATION TELEPHONE SYSTEM; Richard M. Beard, New York, N. Y. App. filed November 4, 1902. A secret service or party telephone line without central with independent wires for connecting the apparatus of any one station with any of the others, and with two groups of local circuits and apparatus.

809,939. APPARATUS FOR RECOVERING PRECIOUS METALS; Edward J. Garvin, Portland, Oregon. App. filed June 16, 1905. Details of construction of a tank for recovering the precious metals in an ore partly by solution and electrolytic deposition and partly by amalgamation.

809,966. STOPPING AND STARTING DEVICE FOR MOTOR DRIVEN APPARATUS; Walter B. Manny, New York, N. Y. App. filed Aug. 1, 1905. A switch for use with motor operated machine such as adding machines, having a spring pressed button in the operator's chair leg so that when the operator leaves the machine. the switch will automatically open and stop the motor.



810,004.—Cable Hanger.

809,996. SYSTEM OF ELECTRICAL DISTRIBUTION; Charles P. Steinmetz, Schenectady, N. Y. App. filed April 13, 1894. Relates to the transformation of two-phase to three-phase currents or from three-phase to two-phase currents by means of two transformers connected in the familiar T method.

809,978. ELECTRIC SAFETY FUSE; Elmer L. Ogle, Peru, Indiana. App. filed May 25, 1904. An auxiliary fuse is connected in parallel with the main fuse and exposed on the outside of the fuse shell. A chemically impregnated paper covers the auxiliary fuse and is in turn covered by a transparent fire-resisting material such as mica. The blowing of the fuse discolors the paper and the mica covering prevents danger from external combustion.

809,982. ELECTRIC SAFETY-FUSE; Charles W. Rhoades, Peru, Indiana. App. filed May 25, 1904. A hinged spring indicator attached to the outer covering of an enclosed fuse and held under tension against it by a thread or wire passing around the fuse, immediately flies to an angular position when the thread is released owing to melting of the fuse.

809,993. CABLE HANGER; Frederick W. Sorg, Englewood, N. J. App. filed Dec. 16, 1903. A sheet metal strap is perforated with a pair of key slots in which a rivet pin may be engaged to hold the strap in clasped relation about the messenger wire and cable. The edges of the key slot are afterward folded in for the purpose of holding the rivet pin more securely.

809,995. ELECTRIC METER; William Stanley, Great Barrington, Mass. App. filed Mar. 7, 1905. The meter has current coils and a needle arranged to oscillate in the field thereof, the rate of oscillation being proportional to the current. The oscillations of the needle are converted into rotary movement so as to register upon the dials. An auxiliary coil is provided to give periodic impulses to the needle compensating for air resistance and friction.

809,999. RAILWAY SIGNALING; Samuel D. Strohm, Philadelphia, Pa. App. filed Aug. 29, 1891. The locomotive is fitted with depending contact brushes which move into different lateral relations under different circumstances. Different contact shoes along the track complete circuits with said brushes in their different positions. The mechanism is arranged to automatically set the danger signals, and to apply the air brakes of a following train in case it passes a danger signal.

810,004. CABLE HANGER; Frank C. Tabler, St. Louis, Mo. App. filed Feb. 6, 1905. A sheet metal hook having a pair of inwardly directed tongues which spring into engagement with the cable when it is placed in the saddle, and prevent its removal.

810,027. ELECTRIC SIGNAL; Charles C. Blake, Brookline, Mass. App. filed Aug. 19, 1905. Relates to a method of setting any desired signal along the road from the train despatcher's office by having pendulums of different vibrating periods at the several stations, and having a series of different pendulums at the despatcher's office which respectively synchronize with the different local pendulums. Impulse currents are transmitted whereby any desired local pendulum may be vibrated and the corresponding signal exhibited.

810,069. OVERHEAD TROLLEY HARP AND SHOE FOR ELECTRIC RAILWAYS; John Miller, Jr., Amesbury, Mass. App. filed Mar. 17, 1905. The patentee uses a pivoted sliding shoe instead of a wheel. The shoe is made in two halves with anti-friction rollers at each end of the groove, and a number of graphite pockets for the purpose of lubrication.

810,150. WIRELESS TRANSMITTING AND RECEIVING MECHANISM FOR ELECTRIC WAVES; Christian Hulsmeyer, Dusseldorf, Germany. App. filed Mar. 14, 1904. Relates to a system of operating any desired distance mechanism, such as fog whistles, gates, signals, etc., by predetermined permutations of wireless impulses. All the receiving devices have clock-operated discs with specially notched peripheries, and it is necessary that the impulses should be received co-incidentally with the movement of the notches in order to operate any particular selected device.

810,144. PROCESS OF TREATING HIDES; Frank B. Hinkson, Newcastle, Pa. App. filed Dec. 27, 1904. The hides are so suspended in the electrolytic tank that each hide is disposed between one pair of electrodes; the current passes transversely through each hide and its direction is reversed at regular intervals.

810,179. APPARATUS FOR MEASURING WATTS IN ELECTRICAL CIRCUITS; Ernest Wilson, London, England. App. filed Dec. 17, 1904. The wattmeter is a quadrant electrometer, the difference of potential applied to the quadrants being obtained from the armature of a dynamo driven at constant speed in a field produced by the current in the work circuit.

810,235. ELECTRICAL MEASURING INSTRUMENT; Thomas W. Varley, New York, N. Y. App. filed Feb. 6, 1905. Instead of having the current coils of the dynamometer themslves create the magnetic field, the patentee makes use of a permanent magnetic field, the direction of which is distorted by the current coils. The potential coils move with the rotable armature or element as usual.

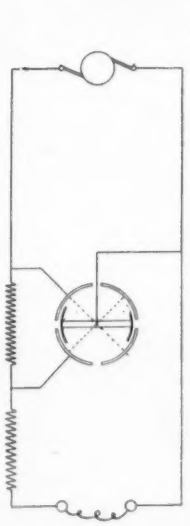
810,240. ELECTRIC MOTOR CONTROLLER REGULATOR; Paul A. Weyland, Maywood, Ill. App. filed June 14, 1905. An attachment for ordinary car controllers, having a plate movable with the controller arm upon which is a freely pivoted lever. The lever cooperates with stationary cam grooves and ratchet teeth in such a way that the controller arm must be moved step by step to its "on" position, but can be swung without resistance to its "off" position from any notch.

810,244. ELECTRIC POCKET BRACKET;; George C. Wright, Cleveland, O. App. filed Mar. 30, 1904. A bracket arranged to swivel on a vertical axis. A pair of concentric rings are engaged by spring-pressed contact studs to make the circuit for any angular relation.

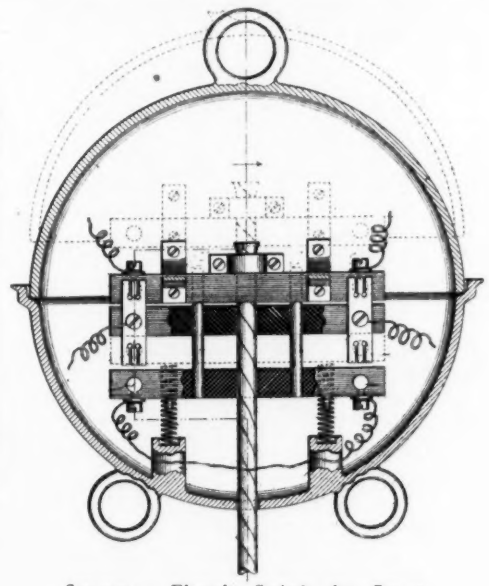
810,262. RAILWAY TRAFFIC CONTROLLING APPARATUS; Clarence W. Coleman, Westfield, N. J. App. filed Mar. 2, 1904. Relates to details of a block-signal system in which the semaphores are operated by the expansion of liquid carbonic acid. The main feature relates to the provision of a supplemental reservoir near the signal into which the gas expands before passing into the motor piston. The purpose is to avoid the stoppage of the motor valves by the solidification of part of the carbonic acid, which would take place if its expansion were allowed to take place in such valves..

810,263. PROCESS OF UTILIZING LIQUIFIED GAS FOR RAILWAY TRAFFIC CONTROLLING APPARATUS; Clarence W. Coleman, Westfield, N. J. App. filed Dec. 12, 1904. Covers the process or method of the apparatus set forth in the preceding patent.

810,269. METHOD OF OPERATING ELECTRIC MOTORS; Arthur C. Eastwood, Cleveland, O. App. filed July 24, 1903.. In order to prevent over-loading a motor, no matter if its armature is entirely



810,330.—Apparatus For Measuring Electric Resistances.



810,357.— Electric Switch for Street Arc Lamps, Etc.

arrested and prevented from turning, the patentee makes use of two motors having their rotatable elements geared together in such a way as to set up counter e. m. f. re-actions, whether the driven devices are rotating or not.

810,311. ELECTRORESPONSIVE DEVICE; Elmer E. Terpening, Geneseo, Ill. App. filed December 17, 1904. Two strong fields created by a pair of permanent electromagnets act upon a coil connected to a main circuit, the oscillations of which actuate mechanism.

810,330. APPARATUS FOR MEASURING ELECTRIC RESISTANCES; Sydney Evershed, Streatley, England. App. filed Feb. 27, 1904. Details of a resistance measuring bridge having an electro-static volt meter for indicating the balance between the resistance arms. The movable part of the electrometer is freely pivoted, and the vibrations of the hand dynamo, included in the outfit, are relied upon to offset the frictional drag of the pivots.

810,357. ELECTRIC SWITCH FOR STREET ARC LAMPS, ETC.; Peter H. F. Spies, New York, N. Y. App. filed Feb. 10, 1905. Relates to street lamps of the kind which can be raised and lowered by a cord. A pair of switch elements are separated by the movement of the lamp when it is lowered. At the same time the two halves of the box which normally encloses the switch elements, separate so as to expose them for inspection or repairs.

810,335. TELEPHONE PARTY-LINE SYSTEM; Frank B. Hall and Arthur F. Poole, Wheeling, W. Va. App. filed Sept. 23, 1901. Each station is connected with a continuous line on one side and with a normally broken line on the other side. The stations are normally connected to ground, and automatic switch apparatus at each station when actuated by current sent over the broken line opens the ground circuit and connects the broken-circuit sections to form a continuous line to the station desired.

810,345. TELEPHONE PARTY-LINE SYSTEM; Arthur F. Poole and Frank B. Hall, Wheeling, W. Va. App. filed Oct. 13, 1902. The apparatus at the substations is successively operated individually, electromagnetic apparatus controlled from the central building up a non-conductive circuit to any desired circuit.

810,346. PARTY-LINE SIGNALING SYSTEM; Arthur F. Poole and Frank B. Hall, Wheeling, W. Va. App. filed Oct. 13, 1902. See 810,335 and 810,345.

810,367. LAMP JACK FOR TELEPHONE SWITCHBOARDS; Sidney A. Beylad, Elyria, Ohio. App. filed Nov. 25, 1904. A metal tube to enclose the lamp, with one side extended and carrying contact springs.